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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 219

Docket No. 121102600-5093-01

RIN 0648-BB87

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries Research

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS' Office of Protected Resources has received a request from NMFS' Southwest Fisheries Science Center (SWFSC) for authorization to take marine mammals incidental to fisheries research conducted in multiple specified geographical regions, over the course of five years from the date of issuance. As required by the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take, specific to each geographical region, and requests comments on the proposed regulations.

DATES: Comments and information must be received no later than [insert date 30 days after date of publication in the FEDERAL REGISTER].

ADDRESSES: You may submit comments on this document, identified by NOAA-NMFS-2015-0026, by any of the following methods:

- Electronic submission: Submit all electronic public comments via the federal e-Rulemaking Portal. Go to www.regulations.gov, enter 0648-BB87 in the “Search” box, click the “Comment Now!” icon, complete the required fields, and enter or attach your comments.

- Mail: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East West Highway, Silver Spring, MD 20910.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. To help NMFS process and review comments more efficiently, please use only one method to submit comments. All comments received are a part of the public record and will generally be posted on www.regulations.gov without change. All personal identifying information (e.g., name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information. NMFS will accept anonymous comments (enter N/A in the required fields if you wish to remain anonymous).

FOR FURTHER INFORMATION CONTACT: Ben Laws, Office of Protected Resources, NMFS, (301) 427-8401.

SUPPLEMENTARY INFORMATION:

Availability

A copy of SWFSC’s application and any supporting documents, as well as a list of the references cited in this document, may be obtained by visiting the Internet at:

www.nmfs.noaa.gov/pr/permits/incidental/research.htm. In case of problems accessing these

documents, please call the contact listed above (see FOR FURTHER INFORMATION CONTACT).

Executive Summary

These proposed regulations, under the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.), establish frameworks for authorizing the take of marine mammals incidental to the SWFSC's fisheries research activities in three separate specified geographical regions (i.e., the California Current Ecosystem, the Eastern Tropical Pacific, and the Antarctic Marine Living Resources Ecosystem).

The SWFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. SWFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. A few surveys are conducted onboard commercial fishing vessels, but the SWFSC designs and executes the studies and funds vessel time.

Purpose and Need for this Regulatory Action

We received an application from the SWFSC requesting five-year regulations and authorization to take multiple species of marine mammals. Take would occur by Level B harassment incidental to the use of active acoustic devices in each of the three specified geographical regions, as well as by visual disturbance of pinnipeds in the Antarctic only, and by Level A harassment, serious injury, or mortality incidental to the use of fisheries research gear in the California Current and Eastern Tropical Pacific only. For each specified geographical region, the regulations would be valid from 2015 to 2019. Please see "Background" below for definitions of harassment.

Section 101(a)(5)(A) of the MMPA directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if, after notice and public comment, the agency makes certain findings and issues regulations. These proposed regulations would contain mitigation, monitoring, and reporting requirements.

Legal Authority for the Regulatory Action

Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I provide the legal basis for issuing the five-year regulations and any subsequent Letters of Authorization.

Summary of Major Provisions within the Proposed Regulations

The following provides a summary of some of the major provisions within these proposed rulemakings for the SWFSC fisheries research activities in the three specified geographical regions. We have preliminarily determined that the SWFSC's adherence to the proposed mitigation, monitoring, and reporting measures listed below would achieve the least practicable adverse impact on the affected marine mammals. They include:

- Required monitoring of the sampling areas to detect the presence of marine mammals before deployment of pelagic trawl nets or pelagic longline gear.
- Required use of marine mammal excluder devices on one type of pelagic trawl net and required use of acoustic deterrent devices on all pelagic trawl nets.
- Required implementation of the mitigation strategy known as the "move-on rule," which incorporates best professional judgment, when necessary during pelagic trawl and pelagic longline operations.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 et seq.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined “negligible impact” in 50 CFR 216.103 as “an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.”

Except with respect to certain activities not pertinent here, the MMPA defines “harassment” as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Summary of Request

On April 25, 2013, we received an adequate and complete request from SWFSC for authorization to take marine mammals incidental to fisheries research activities. We received an initial draft of the request on February 11, 2012, followed by revised drafts on June 29 and December 21, 2012. On May 2, 2013 (78 FR 25703), we published a notice of receipt of SWFSC's application in the Federal Register, requesting comments and information related to the SWFSC request for thirty days. We received comments from the Marine Mammal Commission, which we considered in development of this proposed rule and which are available on the Internet at: www.nmfs.noaa.gov/pr/permits/incidental/research.htm.

SWFSC proposes to conduct fisheries research using pelagic trawl gear used at various levels in the water column, pelagic longlines with multiple hooks, bottom-contact trawls, and other gear. If a marine mammal interacts with gear deployed by SWFSC, the outcome could potentially be Level A harassment, serious injury (i.e., any injury that will likely result in mortality), or mortality. However, there is not sufficient information upon which to base a prediction of what the outcome may be for any particular interaction. Therefore, SWFSC has pooled the estimated number of incidents of take resulting from gear interactions, and we have assessed the potential impacts accordingly. SWFSC also uses various active acoustic devices in the conduct of fisheries research, and use of these devices has the potential to result in Level B harassment of marine mammals. Level B harassment of pinnipeds hauled out on ice may also occur, in the Antarctic only, as a result of visual disturbance from vessels conducting SWFSC research. The proposed regulations would be valid for five years from the date of issuance.

The SWFSC conducts fisheries research surveys in the California Current Ecosystem (CCE), the Eastern Tropical Pacific (ETP), and the Antarctic Marine Living Resources Ecosystem (AMLR). As required by the MMPA, SWFSC's request is considered separately for

each specified geographical region. In the CCE, SWFSC requests authorization to take individuals of seventeen species by Level A harassment, serious injury, or mortality (hereafter referred to as M/SI + Level A) and of 34 species by Level B harassment. In the ETP, SWFSC requests authorization to take individuals of eleven species by M/SI + Level A and of 31 species by Level B harassment. In the AMLR, SWFSC requests authorization to take individuals of seventeen species by Level B harassment. No takes by M/SI + Level A are anticipated in the AMLR.

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Description of the Specified Activity

Overview

The SWFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. SWFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. A few surveys are conducted onboard commercial fishing vessels, but the SWFSC designs and executes the studies and funds vessel time. The SWFSC proposes to administer and conduct approximately fourteen survey programs over the five-year period. The gear types used fall into several categories: pelagic trawl gear used at various levels in the water column, pelagic longlines, bottom-contact trawls, and other gear. Only use of pelagic trawl and pelagic longline

gears are likely to result in interaction with marine mammals. The majority of these surveys also use active acoustic devices.

The federal government has a responsibility to conserve and protect living marine resources in U.S. waters and has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside the United States. NOAA has the primary responsibility for managing marine fin and shellfish species and their habitats, with that responsibility delegated within NOAA to NMFS.

In order to direct and coordinate the collection of scientific information needed to make informed fishery management decisions, Congress created six Regional Fisheries Science Centers, each a distinct organizational entity and the scientific focal point within NMFS for region-based federal fisheries-related research. This research is aimed at monitoring fish stock recruitment, abundance, survival and biological rates, geographic distribution of species and stocks, ecosystem process changes, and marine ecological research. The SWFSC is the research arm of NMFS in the southwest region of the U.S. The SWFSC conducts research and provides scientific advice to manage fisheries and conserve protected species in the three geographic research areas described below and provides scientific information to support the Pacific Fishery Management Council and numerous other domestic and international fisheries management organizations.

Dates and Duration

The specified activity may occur at any time during the five-year period of validity of the proposed regulations. Dates and duration of individual surveys are inherently uncertain, based on congressional funding levels for the SWFSC, weather conditions, or ship contingencies. In addition, the cooperative research program is designed to provide flexibility on a yearly basis in

order to address issues as they arise. Some cooperative research projects last multiple years or may continue with modifications. Other projects only last one year and are not continued. Most cooperative research projects go through an annual competitive selection process to determine which projects should be funded based on proposals developed by many independent researchers and fishing industry participants. SWFSC survey activity does occur during most months of the year; however, trawl surveys occur during May through June and September and longline surveys are completed during June-July and September.

Specified Geographical Regions

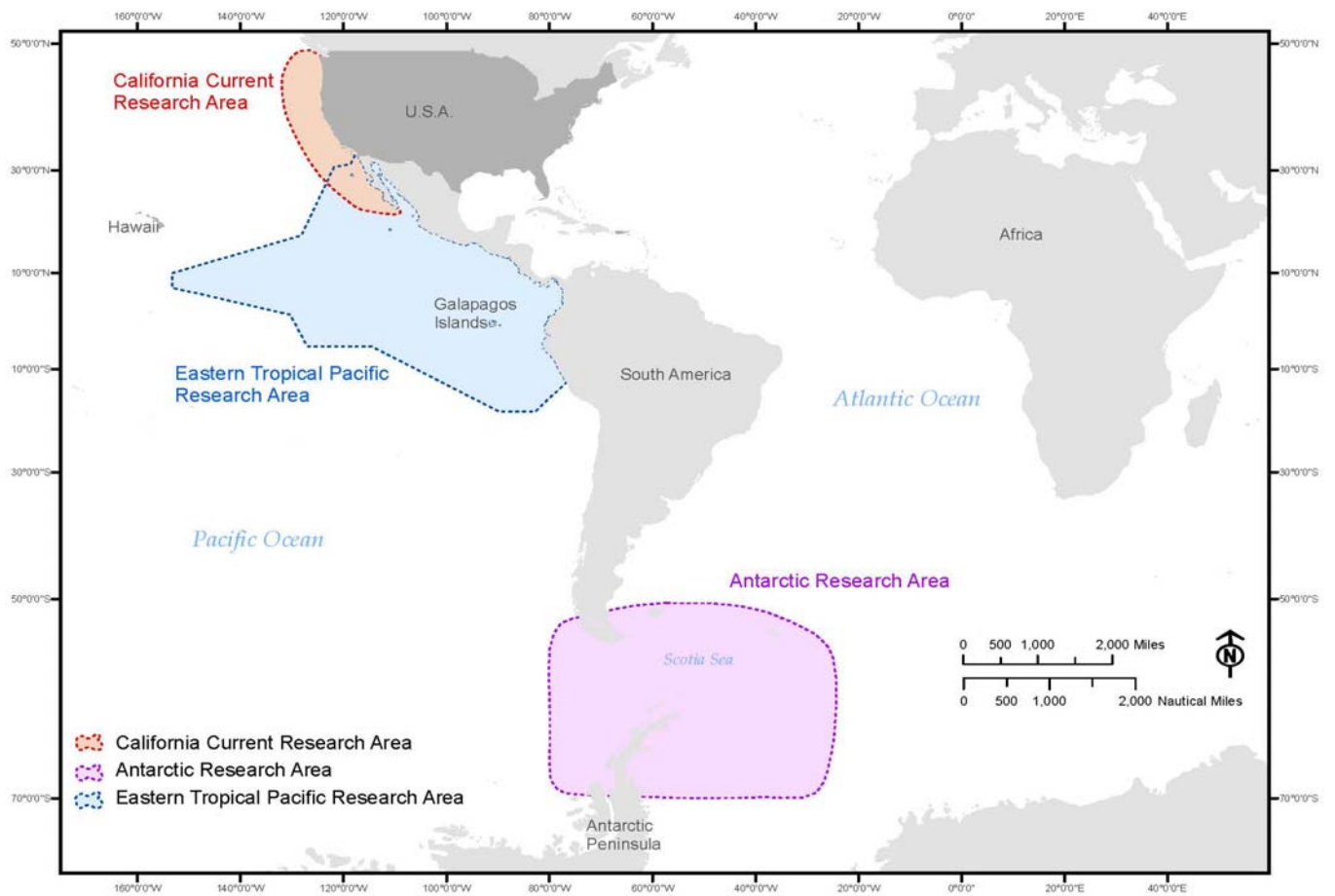
Please see Figure 1 for a map of the three research areas described below. In addition to general knowledge and other citations contained herein, this section relies upon the descriptions found in Sherman and Hempel (2009) and Wilkinson *et al.* (2009). As referred to here, productivity refers to fixated carbon (i.e., g C/m²/yr) and can be related to the carrying capacity of an ecosystem.

California Current Ecosystem – The SWFSC conducts research surveys off the Pacific coast within the California Current Research Area (CCRA). This area extends outside of both the California Current Large Marine Ecosystem (LME) and the U.S. Exclusive Economic Zone (EEZ), from the Mexican Baja Peninsula north to waters off of Washington (see Figure 2.1 of SWFSC's application). This region is considered to be of moderately high productivity. Sea surface temperature (SST) is fairly consistent, ranging from 9-14°C in winter and 13-15°C in summer. Major biogeographic breaks are found at Point Conception and Cape Mendocino, and the region includes major estuaries such as San Francisco Bay, the Columbia River, and Puget Sound. The shelf is generally narrow in this region, and shelf-break topography (e.g., underwater

canyons) creates localized upwelling conditions that concentrate nutrients into areas of high topographic relief.

The California Current determines the general hydrography off the coast of California. The current is part of the North Pacific Gyre, related to the anticyclonic circulation of the central

Figure 1. Southwest Fisheries Science Center research areas



North Pacific, and brings cool waters southward. In general, an area of divergence parallels the coast of California, with a zone of convergence 200-300 km from the coastline. The current moves south along the western coast of North America, beginning off southern British Columbia and flowing southward past Washington, Oregon and California, before ending off southern Baja California (Bograd et al., 2010). Extensive seasonal upwelling of colder, nutrient-rich subsurface waters is predominant in the area south of Cape Mendocino, and supports large populations of whales, seabirds and important fisheries. Significant interannual variation in productivity results from the effects of this coastal upwelling as well as from the El Niño-Southern Oscillation and the Pacific Decadal Oscillation. Both oscillations involve transitions from cooler, more productive conditions to warmer, less productive conditions, but over different timescales.

On the shoreward side of the California Current, the California Current Front separates cold, low-salinity upwelled waters from the warmer, saltier waters close to shore. Offshore frontal filaments transport the frontal water across the entire ecosystem. In winter, the wind-driven Davidson Current is the dominant nearshore system, and its associated front forms along the boundary between inshore subtropical waters and colder offshore temperate and subarctic waters. Surface flow of the California Current appears to be diverted offshore at Point Conception and again at Punta Eugenia, while semi-permanent eddies exist south of these headlands.

Eastern Tropical Pacific – The SWFSC conducts a separate suite of research surveys within the Eastern Tropical Pacific Research Area (ETPRA), a portion of the Pacific Ocean extending from San Diego west to Hawaii and south to Peru (see Figure 2.2 of SWFSC’s application). There is some overlap between the ETPRA and CCRA in nearshore and offshore waters of Baja California. The SWFSC’s ETPRA spans the boundaries of several LMEs, from

the California Current LME in the north to the Humboldt Current LME in the south, and also includes a large amount of offshore waters outside of coastal LME boundaries. The eastern, coastal boundaries of the ETP to the north and south are regions of mixing, characterized by relatively high species diversity and biogeographic transition zones for fish and invertebrates. These areas transition through the furthest extent of influence of south- and north-flowing cool currents into year-round tropical seas.

Located generally within the Pacific Trade Wind Biome, between the subtropical gyres of the North and South Pacific, the ETP contains some of the most productive tropical ocean waters in the world. Cool, low-salinity eastern boundary current waters flow into the ETP from the north and south via the California Current and Peru Current, respectively, while warm, high-salinity subtropical surface waters flow into the ETP after being subducted into the thermocline primarily in the southern Subtropical Convergence. As a result of upwelling, the surface layer has relatively cool temperatures, high salinity, and high nutrient concentrations along the equator, coastal Peru and Baja California, and at the Costa Rica Dome. Nutrient-rich thermocline waters lie close to the surface along the countercurrent thermocline ridge between the North Equatorial Countercurrent and the North Equatorial Current. Deep and bottom waters formed in the Antarctic and North Atlantic are relatively homogeneous in the ETP (Fiedler and Lavin, 2006).

This region is considered to be of moderate to high productivity in coastal regions, as a result of equatorial upwelling, open ocean and coastal upwellings, and nutrient inputs from river runoff in more tropical areas, while the open ocean portions of the ETP are considered to be of low productivity (Longhurst et al., 1995). SST varies considerably, reflecting the region's range

across subtropical to tropical waters. Mean SST ranges around 15-18°C during winter and 19-22°C during summer at higher latitudes to 26-28°C and 29.5°C, respectively, at lower latitudes.

Antarctic Marine Living Resources Ecosystem – The AMLR region includes the waters encircling Antarctica and coincides with the Antarctic LME, which is defined by the Antarctic Convergence (or Polar Front). The convergence, which separates colder Antarctic surface waters from the warmer sub-Antarctic waters to the north, fluctuates seasonally between 48-60°S. The SWFSC's Antarctic Research Area in particular is located generally within the Scotia Sea between South America and the Antarctic Peninsula and encompassing survey areas in the South Shetland Islands and South Orkney Islands (see Figure 2.3 of SWFSC's application). Research is generally conducted in the extended area around the South Shetland and South Orkney archipelagos in the Scotia Sea, the eastern section of the Bellingshausen Sea (on the western side of the Antarctic Peninsula), and the northwestern section of the Weddell Sea.

Cold waters flowing north from Antarctica mix with warm sub-Antarctic waters in the Antarctic Ocean. The Antarctic Circumpolar Current moves eastward around Antarctica, providing a partial return of water to northern ocean basins. There are only limited areas of shallow waters in the Southern Ocean, where the average depth is between 4,000 and 5,000 m over most of its extent, although the southern Weddell Sea is one of the largest shelf areas around the Antarctic continent.

Antarctic waters are considered of moderate productivity. Seasonal production is linked with extreme weather conditions and limited light penetration of winter ice and is strongly influenced by ice formation in the fall and melting in the spring and summer. Antarctic krill is the keystone species of the Antarctic ecosystem, providing an important food source for marine mammals, seabirds, and fishes. Mean SST is approximately -1°C (Locarnini et al., 2006).

Detailed Description of Activities

The federal government has a trust responsibility to protect living marine resources in waters of the United States. These waters extend to 200 nm from the shoreline and include the EEZ. The U.S. government has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside of the U.S. EEZ (i.e., the high seas). To carry out its responsibilities over U.S. and international waters, Congress has enacted several statutes authorizing certain federal agencies to administer programs to manage and protect living marine resources. Among these federal agencies, NOAA has the primary responsibility for protecting marine finfish and shellfish species and their habitats. Within NOAA, NMFS has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources under statutes including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Tuna Conventions Act, the Endangered Species Act, the International Dolphin Conservation Program Act, and the Antarctic Marine Living Resources Convention Act.

Within NMFS, six Regional Fisheries Science Centers direct and coordinate the collection of scientific information needed to inform fisheries management decisions. Each Fisheries Science Center is a distinct entity and is the scientific focal point for a particular region. SWFSC conducts research and provides scientific advice to manage fisheries and conserve protected species along the U.S. west coast, throughout the eastern tropical Pacific Ocean, and in the Southern Ocean off Antarctica. SWFSC provides scientific information to support the Pacific Fishery Management Council and other domestic and international fisheries management organizations.

The SWFSC collects a wide array of information necessary to evaluate the status of exploited fishery resources and the marine environment. SWFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels. A few surveys are conducted onboard commercial fishing vessels, but the SWFSC designs and executes the studies and funds vessel time. The SWFSC proposes to administer and conduct approximately fourteen survey programs over the five-year period.

The gear types used fall into several categories: pelagic trawl gear used at various levels in the water column, pelagic longlines with multiple hooks, bottom-contact trawls, and other gear. Only pelagic trawl and pelagic longline gears are likely to interact with marine mammals. The majority of these surveys also use active acoustic devices. These surveys may be conducted aboard NOAA-operated research vessels (R/V), including the McArthur II, Bell M. Shimada, Miller Freeman, and Reuben Lasker, aboard vessels owned and operated by cooperating agencies and institutions, or aboard charter vessels.

In the following discussion, we first summarily describe various gear types used by SWFSC and then describe specific fisheries and ecosystem research activities conducted by the SWFSC, separated by specified geographical region. This is not an exhaustive list of gear and/or devices that may be utilized by SWFSC but is representative of gear categories and is complete with regard to all gears with potential for interaction with marine mammals. Additionally, relevant active acoustic devices, which are commonly used in SWFSC survey activities, are described separately in a subsequent section.

Trawl nets – A trawl is a funnel-shaped net towed behind a boat to capture fish. The codend (or bag) is the fine-meshed portion of the net most distant from the towing vessel where fish and other organisms larger than the mesh size are retained. In contrast to commercial fishery

operations, which generally use larger mesh to capture marketable fish, research trawls often use smaller mesh to enable estimates of the size and age distributions of fish in a particular area. The body of a trawl net is generally constructed of relatively coarse mesh that functions to gather schooling fish so that they can be collected in the codend. The opening of the net, called the mouth, is extended horizontally by large panels of wide mesh called wings. The mouth of the net is held open by hydrodynamic force exerted on the trawl doors attached to the wings of the net. As the net is towed through the water, the force of the water spreads the trawl doors horizontally apart. The top of a net is called the headrope, and the bottom is called the footrope.

The trawl net is usually deployed over the stern of the vessel and attached with two cables (or warps) to winches on the deck of the vessel. The cables are played out until the net reaches the fishing depth. Commercial trawl vessels travel at speeds of 2-5 kn while towing the net for time periods up to several hours. The duration of the tow depends on the purpose of the trawl, the catch rate, and the target species. At the end of the tow the net is retrieved and the contents of the codend are emptied onto the deck. For research purposes, the speed and duration of the tow and the characteristics of the net must be standardized to allow meaningful comparisons of data collected at different times and locations. Active acoustic devices (described later) incorporated into the research vessel and the trawl gear monitor the position and status of the net, speed of the tow, and other variables important to the research design. Most SWFSC research trawling activities utilize pelagic (or midwater) trawls, which are designed to operate at various depths within the water column but not to contact the seafloor.

1. NETS Nordic 264 – Several SWFSC research programs utilize a Nordic 264 two-warp rope trawl, manufactured by Net Systems, Inc. (Bainbridge Island, WA). The forward portion of this large two-warp rope trawl is constructed of a series of ropes that function to

gather fish into the body of the net. The effective mouth opening of the Nordic 264 is approximately 380 m², spread by a pair of 3-m Lite trawl doors (Churnside et al., 2009). For surface trawls, used to capture fish at or near the surface of the water, clusters of polyfoam buoys are attached to each wing tip of the headrope and additional polyfoam floats are clipped onto the center of the headrope. Mesh sizes range from approximately 163 cm in the throat of the trawl to 9 cm in the codend (Churnside et al. 2009). For certain research activities, a liner may be sewn into the codend to minimize the loss of small fish.

2. Modified-Cobb – A modified-Cobb midwater trawl net has a headrope length of approximately 26 m, a mouth of 80 m² and uses a 0.95-cm codend liner to catch juvenile fish. The net is towed for periods of approximately fifteen minutes at depth at a speed of approximately 2-2.5 kn. The target headrope depth is 30 m for the vast majority of stations but is 10 m for some of the more nearshore (shallow) stations. There are historical and infrequently occupied depth-stratified stations that are also sampled to 100 m depth. The fishing depth is monitored using an electronic net monitoring system and is adjusted by varying the length of trawl line connecting the net to the boat.

3. NETS Hard-Bottom Snapper Trawl – The lower edge of this bottom trawl net is normally protected by a thick footrope ballasted with heavy rubber discs or bobbins, often called roller gear or tire gear. Flotation devices attached to the headrope hold the net open vertically as it is towed through the water. Bottom trawl nets used for commercial purposes can be up to 100 m wide. This net has a headrope length of 28 m and a footrope length of approximately 39 m (Stauffer, 2004). Please see Figure A-2 of SWFSC's EA for a schematic diagram of the net.

Conductivity, temperature, and depth profilers (CTD) – A CTD profiler is the primary research tool for determining chemical and physical properties of seawater (see Figure A-12 of SWFSC's EA for a photograph). A shipboard CTD is made up of a set of small probes attached to a large (1-2 m diameter) metal rosette wheel. The rosette is lowered through the water column on a cable, and CTD data are observed in real time via a conducting cable connecting the CTD to a computer on the ship. The rosette also holds a series of sampling bottles that can be triggered to close at different depths in order to collect a suite of water samples that can be used to determine additional properties of the water over the depth of the CTD cast. A standard CTD cast, depending on water depth, requires two to five hours to complete. The data from a suite of samples collected at different depths are often called a depth profile and are plotted with the value of the variable of interest on the x-axis and the water depth on the y-axis. Depth profiles for different variables can be compared in order to glean information about physical, chemical, and biological processes occurring in the water column.

Conductivity is measured as a proxy for salinity, which is expressed in practical salinity units representing the sum of the concentrations of several different ions. Temperature is generally measured using a high-sensitivity thermistor protected inside a thin-walled stainless steel tube. The resistance across the thermistor is measured as the CTD profiler is lowered through the water column to give a continuous profile of the water temperature at all water depths. The depth of the CTD sensor array is continuously monitored using an electronic pressure sensor. Salinity, temperature, and depth data measured by the CTD instrument are essential for characterization of seawater properties.

Expendable bathythermographs (XBT) – SWFSC also uses Lockheed Martin Sippican's XBT to provide ocean temperature versus depth profiles. A standard XBT system consists of an

expendable probe, a data processing/recording system, and a launcher. An electrical connection between the probe and the processor/recorder is made when the canister containing the probe is placed within the launcher and the launcher breech door is closed. Following launch, wire de-reels from the probe as it descends vertically through the water. Simultaneously, wire de-reels from a spool within the probe canister, compensating for any movement of the ship and allowing the probe to freefall from the sea surface unaffected by ship motion or sea state.

The XBT probes consist of a metal weight surrounding a temperature probe, attached to a copper wire that conducts the signal to the vessel. The copper wire is protected within a plastic housing (see Figure A-13 of SWFSC's EA for a photograph). Probes are generally launched from the leeward side of the vessel and as far aft as possible. Launching from these locations helps obtain high reliability and minimizes the chances that the fine copper probe wire will come in contact with the ship's hull which may cause spikes in the data or a catastrophic wire break. A portable shipboard data acquisition system records, processes, and interprets the data the probes collect.

XBT drops occur at predetermined times along with surface chlorophyll sampling. Opportunistic drops may also occur. Typically, three XBT drops are made per survey day. XBT drops may be repeated if the displayed profile does not show a well-defined mixed layer and thermocline. Deep Blue probes are preferred, as they survey to a depth of 760 m and take approximately two minutes per drop. Probes are launched using a hand-held launcher. As the XBT probes are expendable, they are not retrieved and are left on the seafloor after data collection.

Other nets – SWFSC surveys in all of the research areas utilize various small, fine-mesh, towed nets designed to sample small fish and pelagic invertebrates. These nets can be broadly

categorized as small trawls (which are separated from large trawl nets due to discountable potential for interaction with marine mammals; see “Potential Effects of the Specified Activity on Marine Mammals and Their Habitat”) and plankton nets.

1. The Oozeki net is a frame trawl with a 5 m² mouth area used for quantitative sampling of larval and juvenile pelagic fishes (see Figure A-3 of SWFSC’s EA for a photograph). Towing depth of the net is easily controlled by adjusting the warp length, and the net samples a large size range of juvenile fishes and micronekton (Oozeki et al., 2004).

2. The Isaacs-Kidd midwater trawl (IKMT) is used to collect deepwater biological specimens larger than those taken by standard plankton nets. The mouth of the net is approximately 1.5 x 1.8 m, and is attached to a wide, V-shaped, rigid diving vane that keeps the mouth of the net open and maintains the net at depth for extended periods. The IKMT is a long, round net approximately 6.5 m long, with a series of hoops decreasing in size from the mouth of the net to the codend, which maintain the shape of the net during towing (Yasook et al., 2007). While most trawls must be towed at speeds of 1-2 kn because of the high level of drag exerted by the net in the water, an IKMT can be towed at speeds as high as 5 kn.

3. The Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) uses a stepping motor to sequentially control the opening and closing of the net. The MOCNESS uses underwater and shipboard electronics to control the device. The electronics system continuously monitors the functioning of the nets, frame angle, horizontal velocity, vertical velocity, volume filtered, and selected environmental parameters, such as salinity and temperature. The MOCNESS is used for specialized zooplankton surveys.

4. The Tucker trawl is a medium-sized single-warp net used to study pelagic fish and zooplankton. The Tucker trawl, similar to the MOCNESS, consists of a series of nets that can be opened and closed sequentially via stepping motor without retrieving the net from the fishing depth. It is designed for deep oblique tows where up to three replicate nets can be sequentially operated by a double release mechanism and is typically equipped with a full suite of instruments, including inside and outside flow meters, CTD, and pitch sensor.

The remainder of nets described here are plankton nets, which usually consist of fine mesh attached to a weighted frame which spreads the mouth of the net to cover a known surface area in order to sample plankton and fish eggs from various parts of the water column.

5. Bongo nets are towed through the water at an oblique angle to sample plankton over a range of depths. The Bongo nets used by SWFSC have openings 71 cm in diameter and employ a 505- μ m mesh. The nets are 3 m in length with a 1.5 m cylindrical section coupled to a 1.5 m conical portion that tapers to a detachable codend constructed of 333- μ m or 505- μ m nylon mesh (see Figure A-6 of SWFSC's EA for a schematic diagram). During each plankton tow, the bongo nets are deployed to a depth of approximately 210 m and are then retrieved at a controlled rate so that the volume of water sampled is uniform across the range of depths. In shallow areas, sampling protocol is adjusted to prevent contact between the bongo nets and the seafloor. A collecting bucket, attached to the codend of the net, is used to contain the plankton sample. When the net is retrieved, the collecting bucket can be detached and easily transported to a laboratory. Some bongo nets can be opened and closed using remote control to enable the collection of samples from particular depth ranges. A group of depth-specific bongo net samples can be used to establish the vertical distribution of zooplankton species in the water column at a

site. Bongo nets are generally used to collect zooplankton for research purposes, and are not used for commercial harvest.

6. The Pairovet is a bongo-type device consisting of two nets. The Pairovet frame was designed to facilitate comparison of nets constructed of various materials and to provide replicate observations when using similar nets. The frame is constructed of aluminum with stainless steel fittings. The nets are nylon mesh attached to the frame with adjustable stainless steel strapping.

7. Manta nets are towed horizontally at the surface of the water to sample neuston (organisms living at or near the water surface). The frame of the Manta net is supported at the ocean surface by aquaplanes (wings) that provide lift as the net is towed horizontally through the water (see Figure A-7 of SWFSC's EA for a schematic diagram). To ensure repeatability between samples, the towing speed, angle of the wire, and tow duration must be carefully controlled. The Manta nets used by SWFSC employ 505- μm nylon mesh in the body of the net and 303- μm mesh in the codend. The frame has a mouth area of 0.13 m².

Longline – Longline vessels fish with baited hooks attached to a mainline (or groundline). The length of the longline and the number of hooks depend on the species targeted, the size of the vessel, and the purpose of the fishing activity. Hooks are attached to the mainline by another thinner line called a gangion. The length of the gangion and the distance between gangions depends on the purpose of the fishing activity. Depending on the fishery, longline gear can be deployed on the seafloor (bottom longline), in which case weights are attached to the mainline, or near the surface of the water (pelagic longline), in which case buoys are attached to the mainline to provide flotation and keep the baited hooks suspended in the water. Radar

reflectors, radio transmitters, and light sources are often used to help fishers determine the location of the longline gear prior to retrieval.

A commercial pelagic longline can be over 100 km long and have thousands of hooks attached, although longlines used for research surveys are shorter. The pelagic longline gear used for SWFSC research surveys typically use 200-400 hooks attached to a steel or monofilament mainline from 3-19 km long. For SWFSC research the gangions are 3-11 m long and are attached to the mainline at intervals of 15-30 m. There are no internationally recognized standard measurements for hook size, and a given size may be inconsistent between manufacturers. Larger hooks, as are used in longlining, are referenced by increasing whole numbers followed by a slash and a zero as size increases (e.g., 1/0 up to 20/0). The numbers represent relative sizes, normally associated with the gap (the distance from the point tip to the shank). Because pelagic longline gear is not anchored to the seafloor, it floats freely in the water and may drift considerable distances between the time of deployment and the time of retrieval. Please see Figure A-4 of SWFSC's EA for a schematic diagram. Bottom longlines used for commercial fishing can be up to several miles long, but those used for SWFSC research use shorter lines with approximately 75 hooks per line.

The time period between deployment and retrieval of the longline gear is the soak time. Soak time is an important parameter for calculating fishing effort. For commercial fisheries the goal is to optimize the soak time in order to maximize catch of the target species while minimizing the bycatch rate and minimizing damage to target species that may result from predation by sharks or other predators.

1. Deep-set buoy gear is a particular type of pelagic longline, targeting swordfish (Xiphias gladius), that includes a buoy flotation system (i.e., a strike-indicator float/flag, a large,

non-compressible buoy and a float affixed with a radar reflector). A set of gear consists of 500-lb (227-kg) test mainline monofilament rigged with a 1-2 kg drop sinker to orient the mainline and terminal fishing gear vertically in the water column. Other pelagic longline gear typically uses a long monofilament mainline suspended horizontally near the surface of the water. However, deep-set buoy gear uses a vertically-oriented mainline with two monofilament gangions that branch from the mainline at a target depth below the thermocline (250-400 m for SWFSC) and are constructed of 400-lb (181-kg) test monofilament leader containing a crimped 14/0 circle hook (see Figure A-5 of SWFSC's EA for a schematic diagram).

Continuous, Underway Fish Egg Sampler (CUFES) – The CUFES is used to collect pelagic fish eggs from the water column while the vessel is underway. The CUFES device consists of a water intake approximately 3 m below the surface of the water connected to a high capacity pump capable of pumping approximately 640 L/min through the device. Particles in the bulk water stream are concentrated by an oscillating mesh. Samples are transferred to a collecting device at a rate of approximately 20 L/min, while the bulk water is discharged overboard (see Figure A-8 of SWFSC's EA for a schematic diagram). Samples are collected and preserved on mesh net over sequential sampling intervals. Ancillary data including temperature, salinity, chlorophyll-a fluorescence, time, and location are also collected automatically. The fish eggs within each sequential sample are identified and counted, and the preserved sample is cataloged for future reference.

Remotely operated vehicles (ROV) – The SWFSC maintains and deploys two ROVs (see Figures A-9 and A-10 of the SWFSC's EA for a photograph and schematic diagram, respectively). The ROVs are used to count fish and shellfish, photograph fish for identification, and provide views of the bottom for habitat-type classification studies via still and video camera

images. Precise georeferenced data from ROV platforms also enables SCUBA divers to utilize bottom time more effectively for collection of brood stock and other specimens.

SWFSC operates a Phantom DS4 ROV to collect video and still camera images. The Phantom DS4 platform is driven horizontally by four ½-hp thrusters and vertically by two ¼-hp thrusters, and can operate at a maximum depth of 600 m. Standard instrumentation on the ROV includes a directional hydrophone, a CTD, a differential GPS, pitch and roll sensors, still cameras, and video cameras; additional instrumentation can be added to the platform as needed. The ROV platform also includes a reference laser system to facilitate in situ specimen measurements and to determine the distance of the ROV platform from underwater objects.

The SWFSC has also designed and constructed a custom high-definition high-voltage (HDHV) ROV for surveying deepwater environments. The HDHV ROV is powered by six 300-V brushless DC thrusters, which are efficient and quiet to maximize bottom time while minimizing behavioral disturbance to target species. The HDHV ROV platform is equipped with video and still cameras, an illumination system, scanning sonar, CTD, a dissolved oxygen sensor, laser rangefinding and laser caliper systems, and has the capability to process data while underway to facilitate real-time georeferenced collection of oceanographic data.

California Current Ecosystem – Here we describe all surveys planned by SWFSC in the CCE. Please see Table 1.1 of SWFSC’s application for a detailed summary of these surveys.

1. California Cooperative Oceanic Fisheries Investigations (CalCOFI) Surveys – CalCOFI is a partnership founded in 1949 between NMFS, the California Department of Fish and Game, and Scripps Institution of Oceanography (SIO) to study the ecological aspects of the sardine population collapse off California. CalCOFI’s focus today is more generally the study of the marine environment off the coast of California, the management of its living resources, and

monitoring the indicators of El Niño and climate change. CalCOFI conducts quarterly cruises off southern and central California, collecting a suite of hydrographic and biological data on station and underway. The four annual CalCOFI surveys are designed to describe the physical and biological characteristics of the southern portion of the California Current epipelagic habitat and require a total of approximately ninety survey days per year. More detail may be found in SWFSC documents or at www.calcofi.org.

Winter – This survey is conducted annually during January and February, extending from San Diego to San Francisco, and is designed to capture early spawning hake (Merluccius productus) and some rockfish (Family Scorpaenidae). It is usually conducted on a NOAA ship and protocols include use of multi-frequency active acoustic devices, CUFES, various plankton nets, CTD with an array of vertically profiling instruments and bottles to collect water samples at discrete depths, marine mammal and bird observations, meteorological observations using a wide-range of passive sensors, and small, fine-mesh trawls for sampling mesopelagic organisms at selected stations.

Spring – This survey is conducted annually in April. It also extends from San Diego to San Francisco but is designed to capture spring spawning fishes (e.g., anchovy [Engraulis mordax], sardine [Sardinops sagax], jack mackerel [Trachurus symmetricus]). It is usually conducted on a NOAA ship and the survey protocols are the same as described for the winter survey.

Summer - This survey is conducted annually in July in the Southern California Bight solely on a SIO University-National Oceanographic Laboratory System (UNOLS) vessel. Protocols are the same as for the winter and spring surveys.

Fall – This survey is conducted annually in October in the Southern California Bight, usually on a UNOLS vessel. Protocols are the same as for the other surveys.

2. Coastal Pelagic Species Surveys – These surveys, also known as sardine surveys, are conducted annually or biennially in the spring (April-May) or the summer (July-August) and extend from San Diego, CA, to Cape Flattery, WA. The survey is broken into southern and northern portions on two survey vessels (either two NOAA ships or a NOAA ship and a charter vessel), with the southern portion done in conjunction with the spring or summer CalCOFI survey. Midwater trawling for sardines informs the annual assessment of sardine and the corresponding harvest guidelines. The survey requires about seventy survey days per year.

The protocol for the sardine survey includes deployment of the NETS Nordic 264 two-warp rope trawl in the upper 10 m of the water column at night in order to sample adult sardines. The trawl is deployed for thirty-minute tows at the target depth at 3 kn during dark hours when sardines are dispersed and near the surface. Estimates of daily fecundity are derived from the samples and combined with estimates of daily egg production to produce an estimate of spawning stock biomass. Additional protocols for this survey are similar to the CalCOFI surveys described previously.

3. Juvenile Salmon Survey – This survey is conducted annually in June and September, extending from central California to southern Oregon, and is designed to complement similar surveys conducted by NMFS' Northwest Fisheries Science Center. The survey measures ocean survival of juvenile salmon (coho [Oncorhynchus kisutch] and chinook [O. tshawytscha]) and produces early estimates of adult salmon returns. The juvenile salmon survey is usually conducted on a charter vessel and requires about thirty survey days. The protocols for this survey include deployment of the NETS Nordic 264 midwater trawl for thirty-

minute tows at the target depth during daylight hours at 15-30 m depth. Depending on vessel capabilities, additional operations may include multi-frequency active acoustic devices, CTD profiles, plankton tows, and single-warp Tucker midwater trawls.

4. Juvenile Rockfish Survey – This survey, conducted annually from May to mid-June from southern California to Washington, targets the pelagic phase of juvenile rockfish. Results of the survey inform assessments of several rockfish populations and may be used in assessments of central California salmon productivity. It is either conducted on a NOAA ship or a charter vessel and requires about 45 survey days. The protocols for this survey include underway multi-frequency active acoustic devices, modified-Cobb midwater trawls, various plankton tows, and CTD profiles at fixed stations. The modified-Cobb trawl is deployed for fifteen-minute tows at 2 kn during dark hours at 15-30 m depth.

5. Pacific Coast Ocean Observing System (PaCOOS) Central California – This survey is conducted annually in July and October and involves the extension of CalCOFI observation protocols to established CalCOFI transect lines off Monterey Bay and San Francisco during summer and fall surveys when the CalCOFI sampling grid is confined to the Southern California Bight. Surveys are conducted in conjunction with the Monterey Bay Aquarium Research Institute (MBARI); the University of California, Santa Cruz; and the Naval Postgraduate School, and are usually conducted on the Moss Landing Marine Laboratories R/V Point Sur, lasting about six survey days. Protocols include the use of various plankton nets, CTD profiles, marine mammal and bird observations, and meteorological observations using a wide-range of passive sensors.

6. PaCOOS Northern California – These are monthly plankton and oceanographic surveys of a single line of stations off of Eureka, CA conducted in conjunction with Humboldt

State University (HSU) and usually conducted on the HSU R/V Coral Sea. The surveys require about twelve survey days per year. Protocols are generally the same as those described for PaCOOS Central California.

7. Highly Migratory Species (HMS) Survey – This survey is conducted annually from June through July and extends from southern to central California, targeting blue sharks (Prionace glauca), shortfin mako sharks (Isurus oxyrinchus) and swordfish as well as other HMS as a basis for stock assessments and support for HMS Fishery Management Plans. Sharks are caught, measured, tagged, and released. The survey, which requires about thirty survey days, has historically been conducted on a NOAA ship but in recent years has been conducted on a charter vessel. Primary research methodology involves a pelagic longline deployed at fixed stations with two to four hour soak times. Length of the mainline is 3.2-6.4 km with 200-400 hooks spaced 15-30 m apart, 5.5-m gangions, and 9/0 J-type hooks. When targeting swordfish, the mainline may be up to 19 km in length with 11-m gangions and 16/0 circle-type hooks and soak times may last up to eight hours. Typical bait used is whole mackerel or market squid. Depending on vessel capabilities, additional protocols may include multi-frequency active acoustic devices, CTD profiles, and plankton tows.

8. Thresher Shark Survey – This survey is conducted annually in September, targeting common thresher shark (Alopias vulpinus) pupping areas from the Southern California Bight up to central California. Results of this survey are used to support stock assessment and management of thresher sharks, which are subject to commercial and recreational fisheries. Sharks are caught, measured, sampled, tagged, and released. The survey is usually conducted on a charter vessel and requires about twenty survey days. Primary research methodology involves deployment of an anchored pelagic longline at fixed stations with two to four hour soak times.

Length of the mainline is 3.2-6.4 km with 200-400 hooks spaced 15-30 m apart, 5.5-m gangions and 16/0 circle-type hooks. Typical bait used is whole mackerel or market squid. Depending on vessel capabilities, additional protocols may include the use of multi-frequency active acoustic devices, CTD profiles, and plankton tows.

9. Survey to Research Reproductive Life History Analysis of Sablefish – This survey to research reproductive life history analysis of sablefish (Anoplopoma fimbria) is conducted monthly each year near Bodega Bay off the central California coast. The primary objective of the survey is to collect adult sablefish for reproductive studies using small-scale bottom longline gear. The gear uses 75 hooks per line that are baited with squid and set at or near the bottom, usually at depths between 360-450 m. Two to three sets are made per trip over the course of thirty days per year.

10. Swordfish Tagging Deep-Set Buoy Survey – The swordfish tagging deep-set buoy survey is conducted annually from June through November in the Southern California Bight. The survey's main objective is to investigate the use of this gear to capture swordfish while minimizing bycatch of non-target species. Approximately 300-600 sets are made annually.

11. Marine Mammal Ecosystem Surveys – These large-scale surveys are conducted annually from August to December, and require substantial blocks of continuous time on two NOAA ships (about 60-120 survey days). Results inform status assessments of marine mammal populations. Surveys rotate among geographic areas and do not occur in all specified geographical regions in every year. In the CCE and other offshore waters of the northern Pacific, these projects include the Oregon, California and Washington Line-transect and Ecosystem

survey (ORCAWALE) and the Structure of Populations, Levels of Abundance, and Status of Humpbacks survey (SPLASH; located outside the CCE in the northern Pacific).

Primary effort of these surveys includes line transect surveys of marine mammals and seabirds. Observations are made of schools or aggregations of marine mammals and, for a subset of observations, survey effort is suspended and aggregations are approached for estimation of aggregation size and species composition. This work constitutes research directed at marine mammals, meaning that any take of marine mammals resulting from the survey effort would not be considered incidental. Separate scientific research permits are obtained from NMFS under the MMPA for this component of these surveys; this directed research is therefore not considered further in this document.

However, additional scientific effort during marine mammal ecosystem surveys (e.g., environmental observation) is not directed at marine mammals and take of marine mammals resulting from that effort would be considered incidental take. Therefore, these additional components of marine mammal ecosystem surveys are considered in this document. Additional research protocols include use of multi-frequency active acoustic devices, single-warped IKMT with 1-mm mesh net for sampling macro-zooplankton, 3-m² dip net with 2-mm mesh for sampling flying fish (Family Exocoetidae), CTD profiles, XBTs, and meteorological observations using a wide-range of passive sensors.

12. White Abalone Survey – This survey utilizes still and video camera observations via ROV to monitor population recovery in deep-water habitat for the endangered white abalone (Halotis sorenseni). It is usually conducted on a charter vessel for about 25 survey days. The surveys are confined to offshore banks and island margins, 30-150 m depth, in the Southern California Bight. Since 2002, over 1,000 ROV transects have been conducted along the entire

U.S. west coast. The average and maximum speed of the ROV was 0.5 and 2.4 kn, respectively. The tether that connects the ROV to the ship is 19-mm diameter and is securely attached to a stainless steel cable and down-weight to minimize slack in the tether and to prevent any loops.

13. Collaborative Optical Acoustical Survey Technology (COAST) Survey – These are surveys of offshore banks conducted in collaboration with the charter boat fishing industry to monitor the recovery of rockfish. The COAST surveys are usually conducted on a NOAA ship augmented by a charter vessel and require about forty survey days. Protocols include the use of multi-frequency active acoustic devices and still and video camera observations using an ROV.

14. Habitat Surveys – The focus of these surveys includes adult rockfish Essential Fish Habitat (MSA; see 16 U.S.C. 1802 sec. 3(10)) and habitat use of a variety of other species. They are usually conducted on a NOAA ship for about fifty survey days. The protocols may include use of the Nordic 264 midwater trawl, pelagic longlines, plankton and other small mesoplankton trawls, CTD profiles, and visual observations from ships and submersibles.

15. Small Boats – Numerous field operations use small boats (e.g., for attaching tags to fish). These operations require a total of about 75 survey days per year.

Eastern Tropical Pacific - Here we describe all surveys planned by SWFSC in the ETP. Please see Table 1.1 of SWFSC's application for a detailed summary of these surveys.

1. Marine Mammal Ecosystem Surveys – These surveys, conducted annually during August to December and requiring 60-120 annual survey days, follow the description provided under CCE. Surveys rotate among geographic areas and do not occur in all specified geographical regions in every year. In the ETP and other tropical Pacific waters, these projects include the Stenella Abundance Research survey (STAR) and the Hawaiian Islands Cetacean and

Ecosystem Assessment Survey (HICEAS). The STAR surveys are designed to monitor the recovery of several dolphin stocks (i.e., Stenella spp.) that were depleted by the yellowfin tuna (Thunnus albacares) purse-seine fishery in the ETP.

2. HMS Surveys – To date, these surveys have not been conducted in the ETP; however, the SWFSC believes they will likely occur during the five-year period of validity of this proposed rule. They may be conducted up to thirty days annually during June-July. Protocols follow those described for HMS surveys in CCE.

Antarctic Marine Living Resources Ecosystem - Here we describe all surveys planned by SWFSC in the AMLR. Please see Table 1.1 of SWFSC's application for a detailed summary of these surveys. Surveys occurring in AMLR during austral winter (i.e., June-August) may encounter pinnipeds hauled out on ice. We anticipate that the presence of vessels engaged in SWFSC survey activities may result in behavioral disturbance of these animals. These reactions could result from airborne sound or from visual disturbance alone. It should be noted that these activities do not entail intentional approaches to pinnipeds on ice (i.e., any incidents of behavioral disturbance would constitute incidental take). Behavioral disturbance of this nature is expected only in the AMLR.

1. Antarctic Survey – These surveys are conducted annually during January through March or in August, are usually conducted on a charter vessel, and require about seventy survey days annually. Shipboard surveys are designed to map the distribution of Antarctic krill relative to the distributions of krill predators (e.g., penguins, pinnipeds, and flying birds) as well as to estimate krill biomass within the survey area. The physical and biological environment is also characterized. Every two to three years a bottom trawl is used to assess benthic invertebrates and fish on the continental shelf. Gear used is a towed camera array and the two-warp NET Systems

Hard Bottom Snapper Trawl. Additional protocols include the use of a single-warp IKMT, multi-frequency active acoustic devices, CTD profiles, marine mammal and bird observations, and meteorological observations using a wide-range of passive sensors. SWFSC is also currently investigating use of a single-warp Tucker trawl on these surveys.

Description of Active Acoustic Sound Sources – This section contains a brief technical background on sound, the characteristics of certain sound types, and on metrics used in this proposal inasmuch as the information is relevant to SWFSC’s specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. We also describe the active acoustic devices used by SWFSC.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the “loudness” of a sound and is typically described using the relative unit of the decibel (dB). A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal [μPa]), and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa), while the received level is the SPL at the listener’s position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urlick, 1983). Rms accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 $\mu\text{Pa}^2\text{-s}$) represents the total energy contained within a pulse, and considers both intensity and duration of exposure. For a single pulse, the numerical value of the SEL measurement is usually 5-15 dB lower than the rms sound pressure in dB re 1 μPa , with the comparative difference between measurements of rms and SEL measurements often tending to decrease with increasing range (Greene, 1997; McCauley *et al.*, 1998). Peak sound pressure is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source, and is represented in the same units as the rms sound pressure. Another common metric is peak-to-peak sound pressure (p-p), which is the algebraic difference between the peak positive and peak negative sound pressures. Peak-to-peak pressure is typically approximately 6 dB higher than peak pressure (Southall *et al.*, 2007).

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams (as for the sources considered here) or may radiate in all directions (omnidirectional sources). The compressions and decompressions associated with

sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson et al., 1995), and the sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (e.g., waves, earthquakes, ice, atmospheric sound), biological (e.g., sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (e.g., vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including the following (Richardson et al., 1995):

- Wind and waves: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kHz (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf sound becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions.
- Precipitation: Sound from rain and hail impacting the water surface can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times.
- Biological: Marine mammals can contribute significantly to ambient sound levels, as can some fish and shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz.

- Anthropogenic: Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly. Sound from identifiable anthropogenic sources other than the activity of interest (e.g., a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time – which comprise “ambient” or “background” sound – depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson et al., 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g.,

Ward, 1997 in Southall et al., 2007). Please see Southall et al. (2007) for an in-depth discussion of these concepts.

Pulsed sound sources (e.g., explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

We use generic sound exposure thresholds (see Table 1) to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by harassment might occur. These thresholds should be considered guidelines for estimating when harassment may occur (i.e., when an animal is exposed to levels equal to or exceeding the relevant criterion) in specific contexts; however, useful contextual information that may inform our assessment of effects is typically lacking and we consider these thresholds as step functions. NMFS is currently

revising these acoustic guidelines; for more information on that process, please visit www.nmfs.noaa.gov/pr/acoustics/guidelines.htm. NMFS has determined that the 160-dB threshold for impulsive sources is most appropriate for use in considering the potential effects of the SWFSC's activities.

Table 1. Current acoustic exposure criteria

Criterion	Definition	Threshold
Level A harassment (underwater)	Injury (PTS – any level above that which is known to cause TTS)	180 dB (cetaceans) / 190 dB (pinnipeds) (rms)
Level B harassment (underwater)	Behavioral disruption	160 dB (impulsive source) / 120 dB (continuous source) (rms)

A wide range of active acoustic devices are used in SWFSC fisheries surveys for remotely sensing bathymetric, oceanographic, and biological features of the environment. Most of these sources involve relatively high frequency, directional, and brief repeated signals tuned to provide sufficient focus and resolution on specific objects. SWFSC also uses passive listening sensors (i.e., remotely and passively detecting sound rather than producing it), which do not have the potential to impact marine mammals. SWFSC active acoustic sources include various echosounders (e.g., multibeam systems), scientific sonar systems, positional sonars (e.g., net sounders for determining trawl position), and environmental sensors (e.g., current profilers).

Mid- and high-frequency underwater acoustic sources typically used for scientific purposes operate by creating an oscillatory overpressure through rapid vibration of a surface, using either electromagnetic forces or the piezoelectric effect of some materials. A vibratory source based on the piezoelectric effect is commonly referred to as a transducer. Transducers are usually designed to excite an acoustic wave of a specific frequency, often in a highly directive beam, with the directional capability increasing with operating frequency. The main parameter characterizing directivity is the beam width, defined as the angle subtended by diametrically opposite “half power” (-3 dB) points of the main lobe. For different transducers at a single

operating frequency the beam width can vary from 180° (almost omnidirectional) to only a few degrees. Transducers are usually produced with either circular or rectangular active surfaces. For circular transducers, the beam width in the horizontal plane (assuming a downward pointing main beam) is equal in all directions, whereas rectangular transducers produce more complex beam patterns with variable beam width in the horizontal plane. Please see Zykov and Carr (2014) for further discussion of electromechanical sound sources.

The types of active sources employed in fisheries acoustic research and monitoring may be considered in two broad categories here, based largely on their respective operating frequency (e.g., within or outside the known audible range of marine species) and other output characteristics (e.g., signal duration, directivity). As described below, these operating characteristics result in differing potential for acoustic impacts on marine mammals.

Category 1 active fisheries acoustic sources include those with high output frequencies (>180 kHz) that are outside the known functional hearing capability of any marine mammal. Sounds that are above the functional hearing range of marine animals may be audible if sufficiently loud (e.g., Møhl, 1968). However, the relative output levels of these sources mean that they would potentially be detectable to marine mammals at maximum distances of only a few meters, and are highly unlikely to be of sufficient intensity to result in behavioral harassment. These sources also generally have short duration signals and highly directional beam patterns, meaning that any individual marine mammal would be unlikely to even receive a signal that would almost certainly be inaudible. Therefore, Category 1 sources are not expected to have any effect on marine mammals and are not considered further in this document.

Category 2 acoustic sources, which are present on most SWFSC fishery research vessels, include a variety of single, dual, and multi-beam echosounders (many with a variety of modes),

sources used to determine the orientation of trawl nets, and several current profilers with lower output frequencies than Category 1 sources. Category 2 active acoustic sources have moderate to high output frequencies (10 to 180 kHz) that are generally within the functional hearing range of marine mammals and therefore have the potential to cause behavioral harassment. However, while likely potentially audible to certain species, these sources have generally short ping durations and are typically focused (highly directional) to serve their intended purpose of mapping specific objects, depths, or environmental features. These characteristics reduce the likelihood of an animal receiving or perceiving the signal. A number of these sources, particularly those with relatively lower output frequencies coupled with higher output levels can be operated in different output modes (e.g., energy can be distributed among multiple output beams) that may lessen the likelihood of perception by and potential impact on marine mammals.

We now describe specific acoustic sources used by SWFSC. The acoustic system used during a particular survey is optimized for surveying under specific environmental conditions (e.g., depth and bottom type). Lower frequencies of sound travel further in the water (i.e., good range) but provide lower resolution (i.e., are less precise). Pulse width and power may also be adjusted in the field to accommodate a variety of environmental conditions. Signals with a relatively long pulse width travel further and are received more clearly by the transducer (i.e., good signal-to-noise ratio) but have a lower range resolution. Shorter pulses provide higher range resolution and can detect smaller and more closely spaced objects in the water. Similarly, higher power settings may decrease the utility of collected data. Power level is also adjusted according to bottom type, as some bottom types have a stronger return and require less power to produce data of sufficient quality. Power is typically set to the lowest level possible in order to receive a clear return with the best data. Survey vessels may be equipped with multiple acoustic systems;

each system has different advantages that may be utilized depending on the specific survey area or purpose. In addition, many systems may be operated at one of two frequencies or at a range of frequencies. Characteristics of these sources are summarized in Table 2.

(1) Multi-Frequency Narrow Beam Scientific Echosounders – Echosounders and sonars work by transmitting acoustic pulses into the water that travel through the water column, reflect off the seafloor, and return to the receiver. Water depth is measured by multiplying the time elapsed by the speed of sound in water (assuming accurate sound speed measurement for the entire signal path), while the returning signal itself carries information allowing “visualization” of the seafloor. Multi-frequency split-beam sensors are deployed from SWFSC survey vessels to acoustically map the distributions and estimate the abundances and biomasses of many types of fish; characterize their biotic and abiotic environments; investigate ecological linkages; and gather information about their schooling behavior, migration patterns, and avoidance reactions to the survey vessel. The use of multiple frequencies allows coverage of a broad range of marine acoustic survey activity, ranging from studies of small plankton to large fish schools in a variety of environments from shallow coastal waters to deep ocean basins. Simultaneous use of several discrete echosounder frequencies facilitates accurate estimates of the size of individual fish, and can also be used for species identification based on differences in frequency-dependent acoustic backscattering between species. The SWFSC operates Simrad EK500 and EK60 systems, which transmit and receive at six frequencies ranging from 18-333 kHz.

(2) Multibeam Echosounder and Sonar – Multibeam echosounders and sonars operate similarly to the devices described above. However, the use of multiple acoustic “beams” allows coverage of a greater area compared to single beam sonar. The sensor arrays for multibeam

echosounders and sonars are usually mounted on the keel of the vessel and have the ability to look horizontally in the water column as well as straight down. Multibeam echosounders and sonars are used for mapping seafloor bathymetry, estimating fish biomass, characterizing fish schools, and studying fish behavior. The SWFSC operates the Simrad ME70 and MS70 systems, which are mounted to the hull of the research vessels and emit frequencies in the 70-120 kHz range.

(3) Single-Frequency Omnidirectional Sonar – Low-frequency, high-resolution, long range fishery sonars operate with user selectable frequencies between 20-30 kHz, which provide longer range and prevent interference from other vessels. These sources provide omnidirectional imaging around the source with three different vertical beamwidths available (single or dual vertical view and 180° tiltable). At the 30-kHz operating frequency, the vertical beamwidth is less than 7° and can be electronically tilted from +10 to -80°, which results in differential transmitting beam patterns. The cylindrical multi-element transducer allows the omnidirectional sonar beam to be electronically tilted down to -60°, allowing automatic tracking of schools of fish within the entire water volume around the vessel. SWFSC operates the Simrad SX90 system.

(4) Acoustic Doppler Current Profiler (ADCP) – An ADCP is a type of sonar used for measuring water current velocities simultaneously at a range of depths. Whereas current depth profile measurements in the past required the use of long strings of current meters, the ADCP enables measurements of current velocities across an entire water column. The ADCP measures water currents with sound, using the Doppler effect. A sound wave has a higher frequency when it moves towards the sensor (blue shift) than when it moves away (red shift). The ADCP works by transmitting "pings" of sound at a constant frequency into the water. As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the

instrument. Due to the Doppler effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to return to the sensor, and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings.

An ADCP anchored to the seafloor can measure current speed not just at the bottom, but at equal intervals to the surface. An ADCP instrument may be anchored to the seafloor or can be mounted to a mooring or to the bottom of a boat. ADCPs that are moored need an anchor to keep them on the bottom, batteries, and a data logger. Vessel-mounted instruments need a vessel with power, a shipboard computer to receive the data, and a GPS navigation system so the ship's movements can be subtracted from the current velocity data. ADCPs operate at frequencies between 75 and 300 kHz.

(5) Net Monitoring Systems – During trawling operations, a range of sensors may be used to assist with controlling and monitoring gear. Net sounders give information about the concentration of fish around the opening to the trawl, as well as the clearances around the opening and the bottom of the trawl; catch sensors give information about the rate at which the codend is filling; symmetry sensors give information about the optimal geometry of the trawls; and tension sensors give information about how much tension is in the warps and sweeps. SWFSC uses the Simrad ITI Catch Monitoring System, which allows monitoring of the exact

position of the gear and of what is happening in and around the trawl, and the Simrad FS70 Third Wire Net Sonde, which allows monitoring of the trawl opening.

Table 2. Operating characteristics of SWFSC active acoustic sources

Active acoustic system	Operating frequencies	Maximum source level	Single ping duration (ms) and repetition rate (Hz)	Orientation/ Directionality	Nominal beamwidth
Simrad EK500 and EK60 narrow beam echosounders	18, <u>38</u> , <u>70</u> , <u>120</u> , <u>200</u> , 333 kHz; primary frequencies italicized	224 dB	Variable; most common settings are 1 ms and 0.5 Hz	Downward looking	7°
Simrad ME70 multibeam echosounder	70-120 kHz	205 dB	0.06-5 ms; 1-4 Hz	Primarily downward looking	130°
Simrad MS70 multibeam sonar	75-112 kHz	206 dB	2-10 ms; 1-2 Hz	Primarily side-looking	60°
Simrad SX90 narrow beam sonar	20-30 kHz	219 dB	Variable	Omnidirectional	4-5° (variable for tilt angles from 0-45° from horizontal)
Teledyne RD Instruments ADCP, Ocean Surveyor	75 kHz	224 dB	0.2 Hz	Downward looking	30°
Simrad ITI Catch Monitoring System	27-33 kHz	214 dB	0.05-0.5 Hz	Downward looking	40°
Simrad FS70 Third Wire Net Sonde	120 kHz	Unknown, maximum transmit power is 1 kW	Variable	Downward looking	40°

Proposed Mitigation

In order to issue an incidental take authorization under section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, “and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses.” Note that taxonomic information for certain species mentioned in this section is provided in the following section (“Description of Marine Mammals in the Area of the Specified Activity”).

Since 2008, the SWFSC has invested significant time and effort in identifying technologies, practices, and equipment to minimize the impact of the proposed activities on marine mammal species and stocks and their habitat. These efforts have resulted in the

consideration of many potential mitigation measures, including those the SWFSC has determined to be feasible and has implemented since 2009 as a standard part of sampling protocols. These measures include the “move-on rule,” protected species visual watches and use of acoustic pingers on trawl gear, as well as use of a marine mammal excluder device (MMED) in Nordic 264 midwater trawls.

Development of Mitigation Measures

In survey year 2008 in the CCE, there were dramatically more incidental takes of marine mammals in research gear, in terms of both interactions and animals captured, than in any other year (historical incidents are detailed below in “Estimated Take by Incidental Harassment, Serious Injury, or Mortality”). The SWFSC had previously conducted over a thousand midwater trawl survey tows over more than 25 years, with very few incidents of marine mammal interactions (Hewitt, 2009), but the number of incidental takes in 2008 exceeded the aggregate total over all preceding years. Following the first SWFSC survey cruise in April 2008, during which a number of marine mammals were captured in trawl gear, the SWFSC convened a workshop involving SWFSC staff with expertise in survey design and operations and marine mammal bycatch mitigation (Hewitt, 2009). Participants worked to determine appropriate mitigation measures and to consider changes to sampling protocols in an effort to reduce marine mammal interactions, and the SWFSC subsequently implemented an expanded mitigation protocol. The SWFSC also allocated resources towards the design, construction, and testing of a MMED that could be incorporated into the Nordic 264 trawl net.

During the 2008 meeting, survey results were reviewed, including all known circumstances associated with instances of marine mammal bycatch (e.g., time of day, distance offshore, forage fish catch, sea conditions), but no obvious association with any factor was noted.

Consensus recommendations from this expert working group included altering the survey protocol to approach the sample station at full speed and conduct trawl operations as soon as possible, in order to avoid attracting marine mammals to the survey activity, and to deploy acoustic deterrent devices (pingers) on the trawl nets. In 2009, the MMED was tested and use of the device added to standard survey protocol for the Nordic 264 net (Dotson et al., 2010). It is unclear to what extent mitigation measures have played a role, but incidental marine mammal interactions have not approached 2008 levels in the years since implementation of expanded mitigation protocols (see Tables 10 and 11).

General Measures

Coordination and communication – When SWFSC survey effort is conducted aboard NOAA-owned vessels, there are both vessel officers and crew and a scientific party. Vessel officers and crew are not composed of SWFSC staff, but are employees of NOAA’s Office of Marine and Aviation Operations (OMAO), which is responsible for the management and operation of NOAA fleet ships and aircraft and is composed of uniformed officers of the NOAA Commissioned Corps as well as civilians. The ship’s officers and crew provide mission support and assistance to embarked scientists, and the vessel’s Commanding Officer (CO) has ultimate responsibility for vessel and passenger safety and, therefore, decision authority. When SWFSC survey effort is conducted aboard cooperative platforms (i.e., non-NOAA vessels), ultimate responsibility and decision authority again rests with non-SWFSC personnel (i.e., vessel’s master or captain). Decision authority includes the implementation of mitigation measures (e.g., whether to stop deployment of trawl gear upon observation of marine mammals). The scientific party involved in any SWFSC survey effort is composed, in part or whole, of SWFSC staff and is led by a Chief Scientist (CS). Therefore, because the SWFSC – not OMAO or any other entity that

may have authority over survey platforms used by SWFSC – is the applicant to whom any incidental take authorization issued under the authority of these proposed regulations would be issued, we require that the SWFSC take all necessary measures to coordinate and communicate in advance of each specific survey with OMAO, or other relevant parties, to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed-upon. This may involve description of all required measures when submitting cruise instructions to OMAO or when completing contracts with external entities. SWFSC will coordinate and conduct briefings at the outset of each survey and as necessary between ship’s crew (CO/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures. The CS will be responsible for coordination with the Officer on Deck (OOD; or equivalent on non-NOAA platforms) to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

Vessel speed – Vessel speed during active sampling rarely exceeds 5 kn, with typical speeds being 2-4 kn. Transit speeds vary from 6-14 kn but average 10 kn. These low vessel speeds minimize the potential for ship strike (see “Potential Effects of the Specified Activity on Marine Mammals and Their Habitat” for an in-depth discussion of ship strike). At any time during a survey or in transit, if a crew member standing watch or dedicated marine mammal observer sights marine mammals that may intersect with the vessel course that individual will immediately communicate the presence of marine mammals to the bridge for appropriate course alteration or speed reduction, as possible, to avoid incidental collisions.

Other gears – The SWFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises. Many of these types of gear (e.g., plankton nets, video camera and ROV deployments) are not considered to pose any risk to marine mammals and are therefore not subject to specific mitigation measures. In addition, specific aspects of gear design, survey protocols (e.g., number of hooks), and frequency of use indicate that certain types of gears that may otherwise be expected to have the potential to result in take of marine mammals (e.g., bottom longline used in sablefish life history surveys) do not pose significant risk to marine mammals and are not subject to specific mitigation measures. However, at all times when the SWFSC is conducting survey operations at sea, the OOD and/or CS and crew will monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

Handling procedures – The SWFSC will implement a number of handling protocols to minimize potential harm to marine mammals that are incidentally taken during the course of fisheries research activities. In general, protocols have already been prepared for use on commercial fishing vessels. Because incidental take of marine mammals in fishing gear is similar for commercial fisheries and research surveys, SWFSC proposes to adopt these protocols, which are expected to increase post-release survival. In general, following a “common sense” approach to handling captured or entangled marine mammals will present the best chance of minimizing injury to the animal and of decreasing risks to scientists and vessel crew. Handling or disentangling marine mammals carries inherent safety risks, and using best professional judgment and ensuring human safety is paramount.

SWFSC staff will be provided with a guide to “Identification, Handling and Release of Protected Species” (see Appendix B.1 of the SWFSC’s application) for more specific guidance on protected species handling and will be required to follow the protocols described therein. SWFSC staff will be instructed on how to identify different species; handle and bring marine mammals aboard a vessel; assess the level of consciousness; remove fishing gear; and return marine mammals to water.

Trawl Survey Visual Monitoring and Operational Protocols

The mitigation requirements described here are applicable to all midwater trawl operations conducted by the SWFSC (currently conducted using the Nordic 264 and modified-Cobb nets). Marine mammal watches (visual observation) will be initiated no less than thirty minutes prior to arrival on station to determine if marine mammals are in the vicinity of the planned sample location. Marine mammal watches will be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation will be conducted using the naked eye and available vessel lighting. The visual observation period typically occurs during transit leading up to arrival at the sampling station, rather than upon arrival on station. However, in some cases it may be necessary to conduct a bongo plankton tow or other small net cast prior to deploying trawl gear. In these cases, the visual watch will continue until trawl gear is ready to be deployed. Aside from this required thirty-minute minimum pre-trawl monitoring period, the OOD/CS and crew standing watch will visually scan for marine mammals during all daytime operations.

The primary purpose of conducting the pre-trawl visual monitoring period is to implement the “move-on rule.” If marine mammals are sighted within 1 nm of the planned set location in the thirty minutes before setting the trawl gear, the vessel will transit to a different

section of the sampling area to maintain a minimum set distance of 1 nm from the observed marine mammals. If, after moving on, marine mammals remain within the 1 nm exclusion zone, the CS or watch leader may decide to move again or to skip the station. However, the effectiveness of visual monitoring may be limited depending on weather and lighting conditions, and it may not always be possible to conduct visual observations out to 1 nm radial distance. The OOD, CS or watch leader will determine the best strategy to avoid potential takes of marine mammals based on the species encountered and their numbers and behavior, position, and vector relative to the vessel, as well as any other factors. For example, a whale transiting through the sampling area in the distance may only require a short move from the designated station, whereas a pod of dolphins in close proximity to the vessel may require a longer move from the station or possibly cancellation of the planned tow if the group follows the vessel. In any case, no trawl gear will be deployed if marine mammals have been sighted within 1 nm of the planned set location during the thirty-minute watch period.

In general, trawl operations will be conducted immediately upon arrival on station (and on conclusion of the thirty-minute pre-watch period) in order to minimize the time during which marine mammals (particularly pinnipeds) may become attracted to the vessel. However, in some cases it will be necessary to conduct small net tows (e.g., bongo net) prior to deploying trawl gear in order to avoid trawling through extremely high densities of gelatinous zooplankton that can damage trawl gear.

Once the trawl net is in the water, the OOD, CS, and/or crew standing watch will continue to visually monitor the surrounding waters and will maintain a lookout for marine mammal presence as far away as environmental conditions allow. If marine mammals are sighted before the gear is fully retrieved, the most appropriate response to avoid marine mammal

interaction will be determined by the professional judgment of the CS, watch leader, OOD and other experienced crew as necessary. This judgment will be based on past experience operating trawl gears around marine mammals (i.e., best professional judgment) and on SWFSC training sessions that will facilitate dissemination of expertise operating in these situations (e.g., factors that contribute to marine mammal gear interactions and those that aid in successfully avoiding such events). Best professional judgment takes into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (e.g., net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. We recognize that it is not possible to dictate in advance the exact course of action that the OOD or CS should take in any given event involving the presence of marine mammals in proximity to an ongoing trawl tow, given the sheer number of potential variables, combinations of variables that may determine the appropriate course of action, and the need to consider human safety in the operation of fishing gear at sea. Nevertheless, we require a full accounting of factors that shape both successful and unsuccessful decisions and these details will be fed back into SWFSC training efforts and ultimately help to refine the best professional judgment that determines the course of action taken in any given scenario (see further discussion in “Proposed Monitoring and Reporting”).

If trawling operations have been suspended because of the presence of marine mammals, the vessel will resume trawl operations (when practicable) only when the animals are believed to have departed the 1 nm exclusion zone. This decision is at the discretion of the OOD/CS and is dependent on the situation.

Standard survey protocols that are expected to lessen the likelihood of marine mammal interactions include standardized tow durations and distances. Standard tow durations of not

more than thirty minutes at the target depth will be implemented, excluding deployment and retrieval time (which may require an additional thirty minutes, depending on target depth), to reduce the likelihood of attracting and incidentally taking marine mammals. Short tow durations decrease the opportunity for marine mammals to find the vessel and investigate. Trawl tow distances will be less than 3 nm – typically 1-2 nm, depending on the specific survey and trawl speed – which is expected to reduce the likelihood of attracting and incidentally taking marine mammals. In addition, care will be taken when emptying the trawl to avoid damage to marine mammals that may be caught in the gear but are not visible upon retrieval. The gear will be emptied as quickly as possible after retrieval in order to determine whether or not marine mammals are present. The vessel's crew will clean trawl nets prior to deployment to remove prey items that might attract marine mammals. Catch volumes are typically small with every attempt made to collect all organisms caught in the trawl.

Marine mammal excluder devices – Excluder devices are specialized modifications, typically used in trawl nets, which are designed to reduce bycatch by allowing non-target taxa to escape the net. These devices generally consist of a grid of bars fitted into the net that allow target species to pass through the bars into the codend while larger, unwanted taxa (e.g., turtles, sharks, mammals) strike the bars and are ejected through an opening in the net. Marine turtle bycatch in the commercial shrimp trawl industry led to the development of turtle excluder devices (TED) (e.g., Mitchell et al., 1995) in the 1970s. TEDs are perhaps the most commonly used excluder devices, but devices designed specifically for the exclusion of marine mammals have also been developed for various fisheries around the world where marine mammal interactions are problematic (e.g., Gibson and Isakssen, 1998; Northridge, 2003).

Similar to TEDs, MMEDs generally consist of a large aluminum grate positioned in the intermediate portion of the net forward of the codend and below an escape opening constructed into the upper net panel above the grate. These devices enable target species to pass through a grid or mesh barrier and into the codend while preventing the passage of marine mammals, which are ejected out through an escape opening or swim back out of the mouth of the net. The angled aluminum grate is intended to guide marine mammals through the escape opening. For full details of design and testing of the SWFSC MMED designed for the Nordic 264 net, please see Dotson et al. (2010). All Nordic 264 trawl nets will be fitted with MMEDs to allow marine mammals caught during trawling operations an opportunity to escape.

MMEDs have not been proven to be fully effective at preventing marine mammal capture in trawl nets (e.g., Chilvers, 2008) and are not expected to prevent marine mammal capture in SWFSC trawl surveys. It is difficult to effectively test such devices, in terms of effectiveness in excluding marine mammals as opposed to effects on target species catchability, because realistic field trials would necessarily involve marine mammal interactions with trawl nets. Use of artificial surrogates in field trials has not been shown to be a realistic substitute (Gibson and Isakssen, 1998). Nevertheless, we believe it reasonable to assume that use of MMEDs may reduce the likelihood of a given marine mammal interaction with trawl gear resulting in mortality. We do not infer causality, but note that annual marine mammal interactions with the Nordic 264 trawl net have been much reduced (relative to 2008) since use of the MMED began (see Table 10).

Two types of nets are used in SWFSC pelagic trawl surveys: the Nordic 264 and the modified-Cobb midwater trawls. As noted, all Nordic 264 nets are outfitted with excluder devices developed specifically for SWFSC survey operations. Modified-Cobb trawl nets are

considerably smaller than Nordic 264 trawl nets (80 m² versus 380 m² net opening), are fished at slower speeds, and have a different shape and functionality than the Nordic 264. Very few marine mammal interactions with SWFSC pelagic trawl gear have involved the modified-Cobb net (five of thirty total incidents from 2006-14; Table 10). Due to the smaller size and different functionality of the modified-Cobb, there is no suitable MMED yet available. However, the SWFSC plans to perform research and design work to develop an effective excluder, if possible, which will not appreciably affect the catchability of the net and therefore maintain continuity of the fisheries research dataset. Please see “Proposed Monitoring and Reporting” for additional discussion.

Acoustic deterrent devices – Acoustic deterrent devices (pingers) are underwater sound-emitting devices that have been shown to decrease the probability of interactions with certain species of marine mammals when fishing gear is fitted with the devices. Multiple studies have reported large decreases in harbor porpoise mortality (approximately eighty to ninety percent) in bottom-set gillnets (nets composed of vertical panes of netting, typically set in a straight line and either anchored to the bottom or drifting) during controlled experiments (e.g., Kraus et al., 1997; Trippel et al., 1999; Gearin et al., 2000). Using commercial fisheries data rather than a controlled experiment, Palka et al. (2008) reported that harbor porpoise bycatch rates in the northeast U.S. gillnet fishery when fishing without pingers was about two to three times higher compared to when pingers were used. After conducting a controlled experiment in a California drift gillnet fishery during 1996-97, Barlow and Cameron (2003) reported significantly lower bycatch rates when pingers were used for all cetacean species combined, all pinniped species combined, and specifically for short-beaked common dolphins (85 percent reduction) and California sea lions (69 percent reduction). While not a statistically significant result, catches of Pacific white-sided

dolphins (which are historically one of the most frequently captured species in SWFSC surveys; see Table 10) were reduced by seventy percent. Carretta et al. (2008) subsequently examined nine years of observer data from the same drift gillnet fishery and found that pinger use had eliminated beaked whale bycatch. Carretta and Barlow (2011) assessed the long-term effectiveness of pingers in reducing marine mammal bycatch in the California drift gillnet fishery by evaluating fishery data from 1990-2009 (with pingers in use beginning in 1996), finding that bycatch rates of cetaceans were reduced nearly fifty percent in sets using a sufficient number of pingers. However, in contrast to the findings of Barlow and Cameron (2003), they report no significant difference in pinniped bycatch.

To be effective, a pinger must emit a signal that is sufficiently aversive to deter the species of concern, which requires that the signal is perceived while also deterring investigation. In rare cases, aversion may be learned as a warning when an animal has survived interaction with gear fitted with pingers (Dawson, 1994). The mechanisms by which pingers work in operational settings are not fully understood, but field trials and captive studies have shown that sounds produced by pingers are aversive to harbor porpoises (e.g., Laake et al., 1998; Kastelein et al., 2000; Culik et al., 2001), and it is assumed that when marine mammals are deterred from interacting with gear fitted with pingers that it is because the sounds produced by the devices are aversive. Two primary concerns expressed with regard to pinger effectiveness in reducing marine mammal bycatch relate to habituation (i.e., marine mammals may become habituated to the sounds made by the pingers, resulting in increasing bycatch rates over time; Dawson, 1994; Cox et al., 2001; Carlström et al., 2009) and the “dinner bell effect” (Dawson, 1994; Richardson et al., 1995), which implies that certain predatory marine mammal species (e.g., sea lions) may

come to associate pingers with a food source (e.g., fish caught in nets) with the result that bycatch rates may be higher in nets with pingers than in those without.

Palka et al. (2008) report that habituation has not occurred on a level that affects the bycatch estimate for the northeast U.S. gillnet fishery, while cautioning that the data studied do not provide a direct method to study habituation. Similarly, Carretta and Barlow (2011) report that habituation is not apparent in the California drift gillnet fishery, with the proportion of pinger-fitted sets with bycatch not significantly different for either cetaceans or pinnipeds between the periods 1996-2001 and 2001-09; in fact, bycatch rates for both taxa overall were lower in the latter period. We are not aware of any long-term behavioral studies investigating habituation. Bycatch rates of California sea lions, specifically, did increase during the latter period. However, the authors do not attribute the increase to pinger use (i.e., the “dinner bell effect”); rather, they believe that continuing increases in population abundance for the species (Carretta et al., 2014) coincident with a decline in fishery effort are responsible for the increased rate of capture. Despite these potential limitations on the effectiveness of pingers, and while effectiveness has not been tested on trawl gear, we believe that the available evidence supports an assumption that use of pingers is likely to reduce the potential for marine mammal interactions with SWFSC trawl gear.

If one assumes that use of a pinger is effective in deterring marine mammals from interacting with fishing gear, one must therefore assume that receipt of the acoustic signal has a disturbance effect on those marine mammals (i.e., Level B harassment). However, Level B harassment that may be incurred as a result of SWFSC use of pingers does not constitute take that must be authorized under the MMPA. The MMPA prohibits the taking of marine mammals by U.S. citizens or within the U.S. EEZ unless such taking is appropriately permitted or

authorized. However, the MMPA provides several narrowly defined exemptions from this requirement (e.g., for Alaskan natives; for defense of self or others; for Good Samaritans [16 U.S.C. 1371(b)-(d)]). Section 109(h) of the MMPA (16 U.S.C. 1379(h)) allows for the taking of marine mammals in a humane manner by federal, state, or local government officials or employees in the course of their official duties if the taking is necessary for “the protection or welfare of the mammal,” “the protection of the public health and welfare,” or “the non-lethal removal of nuisance animals.” SWFSC use of pingers as a deterrent device, which may cause Level B harassment of marine mammals, is intended solely for the avoidance of potential marine mammal interactions with SWFSC research gear (i.e., avoidance of Level A harassment, serious injury, or mortality). Therefore, use of such deterrent devices, and the taking that may result, is for the protection and welfare of the mammal and is covered explicitly under MMPA section 109(h)(1)(A). Potential taking of marine mammals resulting from SWFSC use of pingers is not discussed further in this document.

Pingers will be deployed during all pelagic trawl operations and on all types of midwater trawl nets (i.e., the Nordic 264 and modified-Cobb nets), with two to four pingers placed along the footrope and/or headrope. The vessel’s crew will ensure that pingers are operational prior to deployment. Pingers are manufactured by STM Products (Model DDD-03H), with the following attributes: (1) operational depth of 10-200 m; (2) tones range from 100 ms to seconds in duration; (3) variable frequency of 5-500 kHz; and (4) maximum source level of 176 dB rms re 1 μ Pa at 30-80 kHz. Please see “Marine Mammal Hearing” below for reference to functional and best hearing ranges for marine mammals present in the CCE.

AMLR bottom trawl surveys – The SWFSC has no documented interactions with marine mammals in bottom trawl gear used periodically in the AMLR, and standard trawl protocols

described above are not required for these surveys. Please see “Potential Effects of the Specified Activity on Marine Mammals and Their Habitat” for further discussion of this gear. However, SWFSC staff conduct visual and acoustic surveys prior to deploying bottom trawl gear to assess the bathymetry and whether marine mammals are present in the area. These visual and acoustic surveys have resulted in very few detections of marine mammals during trawling operations. Visual and acoustic monitoring will continue as a regular part of future bottom trawl surveys in the AMLR study area, and if detections increase, indicating a higher potential for marine mammal interactions, we will consider the need to implement the standard trawl protocols described above during AMLR bottom trawl surveys.

Longline Survey Visual Monitoring and Operational Protocols

Visual monitoring requirements for all pelagic longline surveys are the same as those described above for trawl surveys. Please see that section for full details of the visual monitoring and “move-on” protocols. These protocols are not required for bottom longline or vertical longline operations, as there have been no documented marine mammal interactions for SWFSC use of these gears and because we believe there is very little risk of interaction even without these measures. Please see “Potential Effects of the Specified Activity on Marine Mammals and Their Habitat” for further discussion of these gears. In summary, requirements for pelagic longline surveys are to: (1) conduct visual monitoring for a period not less than thirty minutes prior to arrival on station; (2) implement the “move-on rule” if marine mammals are observed within a 1-nm exclusion zone around the vessel; (3) deploy gear as soon as possible upon arrival on station (contingent on clearance of the exclusion zone); and (4) maintain visual monitoring effort throughout deployment and retrieval of the longline gear. As was described for trawl gear, the OOD, CS, or watch leader will use best professional judgment to minimize the risk to marine

mammals from potential gear interactions during deployment and retrieval of gear. If marine mammals are detected during setting operations and are considered to be at risk, immediate retrieval or suspension of operations may be warranted. If operations have been suspended because of the presence of marine mammals, the vessel will resume setting (when practicable) only when the animals are believed to have departed the 1-nm exclusion zone. If marine mammals are detected during retrieval operations and are considered to be at risk, haul-back may be postponed. These decisions are at the discretion of the OOD/CS and are dependent on the situation.

We propose one exception to these requirements for longline gear. If five or fewer California sea lions are sighted within the 1-nm exclusion zone during the thirty-minute pre-clearance period, longline gear may be deployed (observations of more than five California sea lions would trigger the “move-on rule” or suspension of gear deployment or retrieval, as appropriate and, for the latter, as indicated by best professional judgment). This exception has been defined in an effort to strike a balance between the rarity of past interactions between longline gear and California sea lions and the increasing abundance of the species in order to preserve practicability of implementation. Given the anecdotally-observed density of California sea lions in the areas where longline surveys are conducted, the SWFSC believes that implementation of, for example, the “move-on rule” upon observation of five or fewer California sea lions would preclude sampling in some areas and introduce significant bias into survey results. The SWFSC believes that a group size threshold of six represents a reasonable trigger that would allow sampling in areas where target species are likely to be caught without increasing the number of interactions between California sea lions and longline gear.

As for trawl surveys, some standard survey protocols are expected to minimize the potential for marine mammal interactions. Typical soak times are two to four hours, measured from the time the last hook is in the water to when the first hook is brought out of the water (but may be as long as eight hours when targeting swordfish). SWFSC longline protocols specifically prohibit chumming (releasing additional bait to attract target species to the gear). However, spent bait may be discarded during gear retrieval while gear is still in the water. SWFSC believes from prior experience that this practice increases survey efficiency and notes that it has not resulted in marine mammal interactions. Anecdotal observations indicate that pinnipeds do not gather immediately aft of the survey vessel as a result of discarding spent bait. However, if marine mammal interactions with longline gear increase or if SWFSC staff observe that this practice may contribute to increased potential for interactions, we will consider the need to retain spent bait until all gear is retrieved.

We have carefully evaluated the SWFSC's proposed mitigation measures and considered a range of other measures in the context of ensuring that we prescribed the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: (1) the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals, (2) the proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and (3) the practicability of the measure for applicant implementation.

Any mitigation measure(s) we prescribe should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal).

(2) A reduction in the number (total number or number at biologically important time or location) of individual marine mammals exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(3) A reduction in the number (total number or number at biologically important time or location) of times any individual marine mammal would be exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only).

(4) A reduction in the intensity of exposure to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing the severity of behavioral harassment only).

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying particular attention to the prey base, blockage or limitation of passage to or from biologically important areas, permanent destruction of habitat, or temporary disturbance of habitat during a biologically important time.

(6) For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the SWFSC's proposed measures, as well as other measures we considered, we have preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed SWFSC's species descriptions – which summarize available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species – for accuracy and completeness and refer the reader to Sections 3 and 4 of SWFSC's application, as well as to NMFS' Stock Assessment Reports (SARs; www.nmfs.noaa.gov/pr/sars/), instead of reprinting the information here. Tables 3-5 list all species with expected potential for occurrence in the specified geographical regions where SWFSC proposes to conduct the specified activity and summarize information related to the population or stock, including potential biological removal (PBR). For taxonomy, we follow Committee on Taxonomy (2014). PBR, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, is discussed in greater detail later in this document (see "Negligible Impact Analyses"). Species that could potentially occur in the proposed research areas but are not expected to have the potential for interaction with SWFSC research gear or that are not likely to be harassed by SWFSC's use of active acoustic devices are described briefly but omitted from further analysis. These include extralimital species, which are species that do not normally occur in a given area but for which there are one or more occurrence records that are considered beyond the normal range of the species.

For status of species, we provide information regarding U.S. regulatory status under the MMPA and ESA but also provide International Union for the Conservation of Nature (IUCN) status for some species in the ETP and AMLR, where stocks are generally not defined by NMFS. The IUCN systematically assesses the relative risk of extinction for terrestrial and aquatic plant

and animal species via a classification scheme using five designations, including three threatened categories (Critically Endangered, Endangered, and Vulnerable) and two non-threatened categories (Near Threatened and Least Concern) (IUCN, 2014). These assessments are generally made relative to the species' global status, and therefore may have limited applicability when marine mammal stocks are defined because we analyze the potential population-level effects of the specified activity to the relevant stock. However, where stocks are not defined, IUCN status can provide a useful reference.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. Survey abundance (as compared to stock or species abundance) is the total number of individuals estimated within the survey area, which may or may not align completely with a stock's geographic range as defined in the SARs. These surveys may also extend beyond U.S. waters.

California Current Ecosystem

In the CCE, 34 species (with forty managed stocks) are considered to have the potential to co-occur with SWFSC activities. Extralimital species or stocks in the CCE include the Bryde's whale (Balaenoptera edeni brydei) and the North Pacific right whale (Eubalaena japonica). In addition, the sea otter is found in coastal waters of the CCE, with the southern sea otter (Enhydra lutris nereis) found in California and the northern (or eastern) sea otter (E. l. kenyoni; Washington stock only) found in Washington. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document. Most survey activity

occurs offshore and is therefore less likely to interact with coastal species such as harbor porpoise, the coastal stock of bottlenose dolphin, or gray whales (during the northbound migration), although these species are considered further in this document. All managed stocks in the CCE are assessed in NMFS' U.S. Pacific SARs (e.g., Carretta et al., 2014), with the exception of the west coast transient stock of killer whales, the eastern North Pacific stock of the northern fur seal, and the eastern stock of the Steller sea lion, which are considered in the U.S. Alaska SARs (e.g., Allen and Angliss, 2014). All values presented in Table 3 are from the most recent SARs (i.e., 2013).

Two populations of gray whales are recognized, eastern and western North Pacific (ENP and WNP). WNP whales are known to feed in the Okhotsk Sea and off of Kamchatka before migrating south to poorly known wintering grounds, possibly in the South China Sea. The two populations have historically been considered geographically isolated from each other; however, recent data from satellite-tracked whales indicate that there is some overlap between the stocks. Two WNP whales were tracked from Russian foraging areas along the Pacific rim to Baja California (Mate et al., 2011), and, in one case where the satellite tag remained attached to the whale for a longer period, a WNP whale was tracked from Russia to Mexico and back again (IWC, 2012). Between 22-24 WNP whales are known to have occurred in the eastern Pacific through comparisons of ENP and WNP photo-identification catalogs (IWC, 2012; Weller et al., 2011; Burdin et al., 2011), and WNP animals comprised 8.1 percent of gray whales identified during a recent field season off of Vancouver Island (Weller et al., 2012). In addition, two genetic matches of WNP whales have been recorded off of Santa Barbara, CA (Lang et al., 2011). More recently, Urban et al. (2013) compared catalogs of photo-identified individuals from Mexico with photographs of whales off Russia and reported a total of 21 matches. Therefore, a

portion of the WNP population is assumed to migrate, at least in some years, to the eastern Pacific during the winter breeding season.

However, the SWFSC does not believe that any gray whale (WNP or ENP) would be likely to interact with its research gear, and the likelihood of a WNP gray whale being exposed to underwater sound produced by the specified activity is so low as to be discountable. For example, of the approximately 20,000 gray whales migrating annually through the Southern California Bight, it is extremely unlikely that one in close proximity to SWFSC research activity would be one of the approximately twenty WNP whales that have been documented in the eastern Pacific (less than one percent probability). The likelihood that a WNP whale would interact with SWFSC research gear or be exposed to elevated levels of sound from the specified activities is insignificant and discountable, and WNP gray whales are omitted from further analysis.

Table 3. Marine mammals potentially present in the vicinity of SWFSC research activities in the CCE

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) ¹	Stock abundance (CV, N _{min} , most recent abundance survey) ²	PBR	Annual M/SI ³
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						
Gray whale	<u>Eschrichtius robustus</u>	Eastern North Pacific	-; N	19,126 (0.071; 18,017; 2007)	558	127 ¹³
Family Balaenopteridae (rorquals)						
Humpback whale	<u>Megaptera novaeangliae kuzira</u>	California/Oregon/Washington (CA/OR/WA)	E/D; Y	1,918 (0.03; 1,855; 2011)	22 ¹²	≥5.5
Minke whale	<u>Balaenoptera acutorostrata scammoni</u>	CA/OR/WA	-; N	478 (1.36; 202; 2008)	2	0
Sei whale	<u>B. borealis borealis</u>	Eastern North Pacific	E/D; Y	126 (0.53; 83; 2008)	0.17	0
Fin whale	<u>B. physalus physalus</u>	CA/OR/WA	E/D; Y	3,051 (0.18; 2,598; 2008)	16	2.2
Blue whale	<u>B. musculus musculus</u>	Eastern North Pacific	E/D; Y	1,647 (0.07; 1,551; 2011)	9.3 ¹²	1.9
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae						
Sperm whale	<u>Physeter macrocephalus</u>	CA/OR/WA	E/D; Y	971 (0.31; 751; 2008)	1.5	4

Family Kogiidae						
Pygmy sperm whale	<u>Kogia breviceps</u>	CA/OR/WA	-; N	579 (1.02; 271; 2008)	2.7	0
Dwarf sperm whale	<u>K. sima</u>	CA/OR/WA ⁵	-; N	Unknown	Unk.	0
Family Ziphiidae (beaked whales)						
Cuvier's beaked whale	<u>Ziphius cavirostris</u>	CA/OR/WA	-; Y	6,590 (0.55; 4,481; 2008)	45	0
Baird's beaked whale	<u>Berardius bairdii</u>	CA/OR/WA	-; N	847 (0.81; 466; 2008)	4.7	0
Hubbs' beaked whale	<u>Mesoplodon carlhubbsi</u>	CA/OR/WA ⁶	-; Y	694 (0.65; 389; 2008)	3.9	0
Blainville's beaked whale	<u>M. densirostris</u>					
Ginkgo-toothed beaked whale	<u>M. ginkgodens</u>					
Perrin's beaked whale	<u>M. perrini</u>					
Lesser (pygmy) beaked whale	<u>M. peruvianus</u>					
Stejneger's beaked whale	<u>M. stejnegeri</u>					
Family Delphinidae						
Common bottlenose dolphin	<u>Tursiops truncatus truncatus</u>	CA/OR/WA Offshore	-; N	1,006 (0.48; 684; 2008)	5.5	≥2
		California Coastal	-; N	323 (0.13; 290; 2005)	2.4	0.2
Striped dolphin	<u>Stenella coeruleoalba</u>	CA/OR/WA	-; N	10,908 (0.34; 8,231; 2008)	82	0
Long-beaked common dolphin	<u>Delphinus capensis capensis</u>	California	-; N	107,016 (0.42; 76,224; 2009)	610	13.8
Short-beaked common dolphin	<u>D. delphis delphis</u>	CA/OR/WA	-; N	411,211 (0.21; 343,990; 2008)	3,440	64
Pacific white-sided dolphin	<u>Lagenorhynchus obliquidens</u>	CA/OR/WA	-; N	26,930 (0.28; 21,406; 2008)	171	17.8 ¹⁴
Northern right whale dolphin	<u>Lissodelphis borealis</u>	CA/OR/WA	-; N	8,334 (0.4; 6,019; 2008)	48	4.8 ¹⁴
Risso's dolphin	<u>Grampus griseus</u>	CA/OR/WA	-; N	6,272 (0.3; 4,913; 2008)	39	1.6
Killer whale	<u>Orcinus orca</u> ⁴	West Coast Transient ⁷	-; N	243 (n/a; 2006)	2.4	0
		Eastern North Pacific Offshore	-; N	240 (0.49; 162; 2008)	1.6	0
		Eastern North Pacific Southern Resident	E/D; Y	85 (n/a; 2012)	0.14	0
Short-finned pilot whale	<u>Globicephala macrorhynchus</u>	CA/OR/WA	-; N	760 (0.64; 465; 2008)	4.6	0
Family Phocoenidae (porpoises)						
Harbor porpoise	<u>Phocoena phocoena vomerina</u>	Morro Bay	-; N	2,917 (0.41; 2,102; 2012)	21	≥0.6
		Monterey Bay	-; N	3,715 (0.51; 2,480; 2011)	25	0
		San Francisco-Russian River	-; N	9,886 (0.51; 6,625; 2011)	66	0
		Northern CA/Southern OR	-; N	35,769 (0.52; 23,749; 2011)	475	≥0.6
		Northern OR/WA Coast	-; N	21,487 (0.44; 15,123; 2011)	151	≥3
		Washington Inland Waters ^{8,9}	-; N	10,682 (0.38; 7,841; 2003)	Undet.	≥2.2

Dall's porpoise	<u>Phocoenoides dalli dalli</u>	CA/OR/WA	-; N	42,000 (0.33; 32,106; 2008)	257	≥0.4
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
Guadalupe fur seal	<u>Arctocephalus philippii townsendi</u>	s	T/D; Y	7,408 (n/a; 3,028; 1993)	Undet.	0 ¹⁵
Northern fur seal	<u>Callorhinus ursinus</u>	Pribilof Islands/Eastern Pacific	D; Y	639,545 (n/a; 541,317; 2008-11)	11,638	471
		California	-; N	12,844 (n/a; 6,722; 2011)	403	2.6 ¹⁴
California sea lion	<u>Zalophus californianus</u>	United States	-; N	296,750 (n/a; 153,337; 2008)	9,200	≥431 ¹⁴
Steller sea lion	<u>Eumetopias jubatus monteriensis</u>	Eastern U.S. ¹⁰	D; N	63,160-78,198 (n/a; 34,485; 2008-11) ¹¹	1,552	65.1
Family Phocidae (earless seals)						
Harbor seal	<u>Phoca vitulina richardii</u>	California	-; N	30,196 (n/a; 26,667; 2009)	1,600	31
		OR/WA Coast ⁸	-; N	24,732 (0.12; 22,380; 1999)	Undet.	10.6
		Washington Inland Waters ^{8,9}	-; N	14,612 (0.15; 12,844; 1999)	Undet.	13.4
Northern elephant seal	<u>Mirounga angustirostris</u>	California Breeding	-; N	124,000 (n/a; 74,913; 2005)	4,382	≥10.4

¹Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

²NMFS marine mammal stock assessment reports at: www.nmfs.noaa.gov/pr/sars/. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For two stocks of killer whales, the abundance values represent direct counts of individually identifiable animals; therefore there is only a single abundance estimate with no associated CV. For certain stocks of pinnipeds, abundance estimates are based upon observations of animals (often pups) ashore multiplied by some correction factor derived from knowledge of the species' (or similar species') life history to arrive at a best abundance estimate; therefore, there is no associated CV. In these cases, the minimum abundance may represent actual counts of all animals ashore.

³These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, subsistence hunting, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value.

⁴Transient and resident killer whales are considered unnamed subspecies (Committee on Taxonomy, 2014).

⁵No information is available to estimate the population size of dwarf sperm whales off the U.S. west coast, as no sightings of this species have been documented despite numerous vessel surveys of this region (Carretta et al., 2014). Dwarf and pygmy sperm whales are difficult to differentiate at sea but, based on previous sighting surveys and historical stranding data, it is thought that recent ship survey sightings were of pygmy sperm whales.

⁶The six species of Mesoplodont beaked whales occurring in the CCE are managed as a single stock due to the rarity of records and the difficulty in distinguishing these animals to species in the field. Based on bycatch and stranding records, it appears that M. carlhubbsi is the most commonly encountered of these species (Carretta et al., 2008; Moore and Barlow, 2013). Additional managed stocks in the Pacific include M. stejnegeri in Alaskan waters and M. densirostris in Hawaiian waters.

⁷The abundance estimate for this stock includes only animals from the "inner coast" population occurring in inside waters of southeastern Alaska, British Columbia, and Washington – excluding animals from the "outer coast" subpopulation, including animals from California – and therefore should be considered a minimum count. For comparison, the previous abundance estimate for this stock, including counts of animals from California that are now considered outdated, was 354.

⁸Abundance estimates for these stocks are greater than eight years old and are not considered current. PBR is therefore considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates, as these represent the best available information for use in this document.

⁹Based on location of SWFSC research, no take is likely to occur for Washington inland waters stocks. Therefore, such stocks of harbor porpoise and harbor seal are excluded from further analysis.

¹⁰The eastern distinct population segment of the Steller sea lion, previously listed as threatened, was delisted under the ESA on December 4, 2013 (78 FR 66140; November 4, 2013).

¹¹Best abundance is calculated as the product of pup counts and a factor based on the birth rate, sex and age structure, and growth rate of the population. A range is presented because the extrapolation factor varies depending on the vital rate parameter resulting in the growth rate (i.e., high fecundity or low juvenile mortality).

¹²These stocks are known to spend a portion of their time outside the U.S. EEZ. Therefore, only a portion of the PBR presented here is allocated for U.S. waters. U.S. PBR allocation is one-quarter of the total for blue whales (2.3) and half the total for humpback whales (11). Annual M/SI presented for these species is for U.S. waters only.

¹³Includes annual Russian harvest of 123 whales.

¹⁴These species have been historically taken in SWFSC research surveys (see Tables 10 and 11). Values for total annual human-caused M/SI include 6.0 Pacific white-sided dolphins, 1.2 northern right whale dolphins, 1.0 northern fur seals (California stock), and 3.0 California sea lions taken annually in SWFSC research surveys. Two northern fur seals from the eastern Pacific stock were taken in SWFSC research surveys between 2007-11, but these mortalities are not accounted for in the total annual M/SI value presented in the SAR.

¹⁵This represents annual M/SI in U.S. waters. However, the vast majority of M/SI for this stock – the level of which is unknown – would likely occur in Mexican waters.

Take reduction planning – Take reduction plans are designed to help recover and prevent the depletion of strategic marine mammal stocks that interact with certain U.S. commercial fisheries, as required by Section 118 of the MMPA. The immediate goal of a take reduction plan is to reduce, within six months of its implementation, the M/SI of marine mammals incidental to commercial fishing to less than the PBR level. The long-term goal is to reduce, within five years of its implementation, the M/SI of marine mammals incidental to commercial fishing to insignificant levels, approaching a zero serious injury and mortality rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans. Take reduction teams are convened to develop these plans.

For marine mammals in the California Current Ecosystem, there is currently one take reduction plan in effect (Pacific Offshore Cetacean Take Reduction Plan). The goal of this plan is to reduce M/SI of several marine mammal stocks incidental to the California thresher shark/

swordfish drift gillnet fishery (CA DGN). A team was convened in 1996 and a final plan produced in 1997 (62 FR 51805; October 3, 1997). Marine mammal stocks of concern initially included the California, Oregon, and Washington stocks for all CCE beaked whales, short-finned pilot whales, pygmy sperm whales, sperm whales, and humpback whales. The most recent five-year averages of M/SI for these stocks are below PBR, and none of these species were taken in the fishery in 2012-13. More information is available on the Internet at:

www.nmfs.noaa.gov/pr/interactions/trt/poctrp.htm. Of the stocks of concern, the SWFSC has requested the authorization of incidental M/SI + Level A for the short-finned pilot whale only (see “Estimated Take by Incidental Harassment” later in this document). The most recent reported average annual human-caused mortality for short-finned pilot whales (2004-08) is zero animals. The SWFSC does not use drift gillnets in its fisheries research program; therefore, take reduction measures applicable to the CA DGN fisheries are not relevant to the SWFSC.

Unusual Mortality Events (UME) – A UME is defined under the MMPA as “a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response.” From 1991 to the present, there have been fifteen formally recognized UMEs on the U.S. west coast involving species under NMFS’ jurisdiction. The most recent of these, and the only one involving a currently ongoing investigation, involved California sea lions. Beginning in January 2013, elevated strandings of California sea lion pups were observed in southern California, with live sea lion strandings nearly three times higher than the historical average. Findings to date indicate that a likely contributor to the large number of stranded, malnourished pups was a change in the availability of sea lion prey for nursing mothers, especially sardines. The causes and mechanisms of this UME remain under

investigation (www.nmfs.noaa.gov/pr/health/mmume/californiasealions2013.htm; accessed May 8, 2014).

Additional UMEs in the past ten years include those involving harbor porpoises in California (2008; cause determined to be ecological factors); Guadalupe fur seals in the northwest (2007; undetermined); large whales in California (2007; human interaction); cetaceans in California (2007; undetermined); and harbor porpoises in the Pacific Northwest (2006; undetermined). For more information on UMEs, please visit the Internet at: www.nmfs.noaa.gov/pr/health/mmume/.

Eastern Tropical Pacific

In the ETP, 32 species – including multiple stocks for some species – are considered to have the potential to co-occur with SWFSC activities. As in the CCE, an undifferentiated stock of Mesoplodont beaked whales (Mesoplodon spp.) is present, but is not defined in the sense that the U.S.-managed CCE stock is. In the ETP, Mesoplodont beaked whales likely include Blainville's, ginkgo-toothed, and lesser (pygmy) beaked whales, but would encompass any Mesoplodont species occurring in the ETP. Although some of the ETP species are the same as those found in the CCE, in many cases different stocks or populations are present than those found in the CCE. However, because the majority of these do not constitute stocks under U.S. jurisdiction, the stocks are not managed by NMFS and there are no SARs. Therefore, substantially less information is available for these species in relation to the stocks or populations and their occurrence in the ETP (e.g., PBR is generally not calculated for ETP stocks, and strategic designations are not made). Extralimital species in the ETP include the pygmy sperm whale, southern bottlenose whale (Hyperoodon planifrons), long-finned pilot whale (Globicephala melas), Burmeister's porpoise (Phocoena spinipinnis), and Dall's porpoise.

Table 4. Marine mammals potentially present in the vicinity of SWFSC research activities in the ETP

Common name	Scientific name	Stock ²	ESA/ MMPA/ IUCN status ³	Abundance (CV, N _{min}) ⁵	PBR ¹⁶
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)					
Family Balaenopteridae (rorquals)					
Humpback whale	<u>Megaptera novaeangliae</u>	CA/OR/WA & Breeding Stock G	E/D/LC	2,566 ⁶	-
Minke whale	<u>Balaenoptera acutorostrata scammoni</u>		-/LC	115 ⁶	-
Bryde’s whale	<u>B. edeni brydei</u>	Eastern North Pacific & Peruvian	-/DD	10,411 (0.20) ⁷	-
Sei whale	<u>B. borealis borealis</u>		E/D/EN	0 ⁶	-
Fin whale	<u>B. physalus physalus</u>		E/D/EN	574 ⁶	-
Blue whale	<u>B. musculus musculus</u>	Eastern North Pacific	E/D/EN	1,415 (0.24) ⁸	-
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)					
Family Physeteridae					
Sperm whale	<u>Physeter macrocephalus</u>		E/D/VU	4,145 (0.73) ⁷	-
Family Kogiidae					
Dwarf sperm whale	<u>Kogia sima</u>		-/DD	11,200 (0.29; 8,789) ⁸	88
Family Ziphiidae (beaked whales)					
Cuvier’s beaked whale	<u>Ziphius cavirostris</u>		-/LC	20,000 (0.27) ^{8,9}	-
Longman’s beaked whale	<u>Indopacetus pacificus</u>		-/DD	1,007 (1.26) ¹⁰	-
Blainville’s beaked whale	<u>Mesoplodon densirostris</u>		-/DD	25,300 (0.20) ⁸	-
Ginkgo-toothed beaked whale	<u>M. ginkgodens</u>				
Lesser (pygmy) beaked whale	<u>M. peruvianus</u>				
Family Delphinidae					
Rough-toothed dolphin	<u>Steno bredanensis</u>		-/LC	107,663 (0.22; 89,653) ¹¹	897
Common bottlenose dolphin	<u>Tursiops truncatus truncatus</u>		-/LC	335,834 (0.20; 284,952) ¹¹	2,850
Striped dolphin	<u>Stenella coeruleoalba</u>		-/LC	964,362 (0.21; 811,592) ¹¹	8,116
Pantropical spotted dolphin	<u>S. attenuata attenuata</u>	Northeastern Offshore	-/D ⁴	857,884 (0.23) ¹¹	12,334
		Western and Southern Offshore	-	439,208 (0.29) ¹¹	
Spinner dolphin	<u>S. a. graffmani</u>	Coastal	-/D ⁴	278,155 (0.59) ¹¹	-
	<u>S. longirostris</u>	Whitebelly	-	734,837 (0.61) ¹¹	-
	<u>S. l. orientalis</u>	Eastern	-/D ⁴	1,062,879 (0.26) ¹¹	-
	<u>S. l. centroamericana</u>	Central American	-	Unknown	-
Long-beaked common dolphin	<u>Delphinus capensis capensis</u>		-/DD	372,429 (0.36; 278,651) ⁶	2,787
Short-beaked common dolphin	<u>D. delphis delphis</u>	Northern	-	3,127,203 (0.26; 2,513,269) ¹¹	25,133
		Central			
		Southern			
Fraser’s dolphin	<u>Lagenodelphis hosei</u>		-/LC	289,300 (0.34) ⁸	-
Dusky dolphin	<u>Lagenorhynchus obscurus posidonia</u>		-/DD	40,211 ⁶	-
Risso’s dolphin	<u>Grampus griseus</u>		-/LC	110,457 (0.35; 83,092) ¹¹	831
Melon-headed whale	<u>Peponocephala electra</u>		-/LC	45,400 (0.47) ⁸	-
Pygmy killer whale	<u>Feresa attenuata</u>		-/DD	38,990 (0.31) ⁸	-
False killer whale	<u>Pseudorca crassidens</u>		-/DD	39,800 (0.64) ⁸	244
Killer whale	<u>Orcinus orca</u> ¹		-/DD	8,500 (0.37; 24,365) ⁸	-
Short-finned pilot whale	<u>Globicephala macrorhynchus</u>		-/DD	589,315 (0.26; 475,141) ⁷	4,751

Order Carnivora – Superfamily Pinnipedia					
Family Otariidae (eared seals and sea lions)					
Guadalupe fur seal	<u>Arctocephalus philippii townsendi</u>		T/D/NT	Unknown ^{12,13}	-
California sea lion	<u>Zalophus californianus</u>		-/LC	105,000 ^{12,14}	1,050
South American sea lion	<u>Otaria byronia</u>		-/LC	150,000 ^{12,15}	1,500
Northern elephant seal	<u>Mirounga angustirostris</u>		-/LC	Unknown ^{12,13}	-

¹Defined ecotypes have not yet been recognized for the ETP, although available evidence (e.g., observed predation on marine mammals, genetic analysis) indicates that observed animals may be of the transient ecotype (e.g., Pitman et al., 2007; Olson and Gerrodette, 2008).

²For most species in the ETP, stocks are not delineated and entries refer generally to individuals of the species occurring in the ETP. Coastal regions of the ETP include wintering areas for humpback whales from both the northern (CA/OR/WA [i.e., U.S.-managed] stock; M. n. kuzira) and southern (Breeding Stock G, which feeds off the Antarctic Peninsula and southern Chile; M. n. australis) hemispheres. The IWC recognizes eastern North Pacific and Peruvian stocks of Bryde's whale (Carretta et al., 2007), although Wade and Gerrodette (1993) suggested that Bryde's whales in the ETP may comprise two stocks based on a gap in distribution between 7°N and 9°N. The offshore form of the pantropical spotted dolphin is found in oceanic tropical waters worldwide, while the coastal form is found only in coastal waters of the ETP. These two forms are recognized as subspecies. Offshore spotted dolphins occurring in the ETP are divided into a northeastern and combined western/southern stock. Whitebelly spinner dolphins are considered hybrids of the eastern spinner and the Gray's spinner (S. l. longirostris; Gray's spinner is a subspecies found in oceanic tropical waters worldwide), and is considered a stock for management purposes. The Central American subspecies is restricted to coastal waters over the ETP shelf, from southern Mexico to Costa Rica. The eastern subspecies is found in pelagic waters of the ETP east of 145°W, from 24°N off Baja California to 10°S off Peru, exclusive of the range of S. l. centroamericana. Short-beaked common dolphins are divided into northern, central and southern stocks, although no recent stock-specific abundance estimates are available. A hiatus at 13-20°N and at about 3°N divide the offshore populations into the respective stocks. The central form occurs at 3-18°N and the southern common dolphin ranges from 3°N to at least 13°S (Dizon et al. 1994).

³Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Any species listed under the ESA is automatically designated under the MMPA as depleted. IUCN status: Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD). IUCN status not provided for species with defined stocks in the ETP.

⁴These stocks of the genus Stenella are designated as depleted under the MMPA due to high levels of bycatch in the yellowfin tuna purse-seine fishery in the eastern tropical Pacific beginning in the 1950s.

⁵CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV and/or N_{min} is not available. These metrics are not applicable to either species of sea lion because population estimates were made based on counts of animals in aerial photographs. These counts are considered as actual population size so there is no associated error.

⁶Unpublished abundance estimates derived by SWFSC from 1998-2000, 2003, and 2006 ETP survey data reported in Kinzey et al. (1999; 2000; 2001) and Jackson et al. (2004; 2008). NMFS' policy is that abundance estimates greater than eight years old are not considered current; however, these data represent the best available information for these species. CVs were not calculated for these species. Wade and Gerrodette (1993) provide a CV of 0.64 for false killer whales; it is the highest CV reported in that paper or that we are aware of for the ETP. We suggest here that this is an appropriate conservative proxy for species for which there is no calculated CV.

⁷Abundance estimates derived from 2000 ETP survey data, as reported in Gerrodette and Forcada (2002).

⁸Abundance estimates derived from 1986-1990 ETP survey data, as reported in Wade and Gerrodette (1993).

⁹Abundance estimate for Cuvier's beaked whale is considered to be an underestimate, as it is not corrected for animals missed along the survey track line. The abundance estimate for unidentified Ziphiids was prorated between Cuvier's beaked whales and Mesoplodon spp.

¹⁰Abundance estimate derived from 2002 Hawaiian EEZ survey data, as reported in Barlow (2006).

¹¹Abundance estimates derived from 2006 ETP survey data, as reported in Gerrodette et al. (2008).

¹²With the exception of the South American sea lion, which is generally observed along the Peruvian coast, all pinniped species are typically sighted only at the northern end of the ETPRA along the coast of Baja California.

¹³The best abundance estimates for all Guadalupe fur seals and for the California breeding population of northern elephant seals are 7,408 and 124,000, respectively, as reported in NMFS' SARs. However, no estimate specific to the ETP exists for either species.

¹⁴Abundance estimate is the sum of estimates for western Baja California, Mexico (75,000-87,000; Lowry and Maravilla-Chavez, 2005) and the Gulf of California (24,062-31,159; Szteren *et al.* 2006). We used the lower bound for Baja California and rounded down the upper bound for the Gulf of California for an approximate total abundance of 105,000. Because abundance is based on actual counts, there is no error associated with the estimate.

¹⁵Abundance estimate is the sum of estimates for Peru (60,000) and Chile (90,000-100,000) (Campagna, 2008). Although it is unlikely that this entire population would occur in the ETPRA, we assume here that it would. Because abundance is based on actual counts, there is no error associated with the estimate.

¹⁶PBR calculated for this analysis by SWFSC for species anticipated to be taken by M/SI + Level A only using accepted calculations for minimum population estimates and PBR (NMFS, 2005) and assuming $F_r = 0.5$ and $R_{max} = 0.04$ for cetaceans and 0.12 for pinnipeds. A pooled PBR was calculated for all stocks of the pantropical spotted dolphin.

Antarctic Marine Living Resources Ecosystem

The SWFSC's Antarctic Research Area (ARA) comprises a portion of the AMLR ecosystem. In the ARA, seventeen species are considered to have the potential to co-occur with SWFSC activities. Marine mammals in the AMLR do not constitute stocks under U.S. jurisdiction; therefore, the stocks are not managed by NMFS, there are no SARs, and substantially less information is available for these species in relation to the stocks or populations and their occurrence in the ARA than is available for CCE stocks (e.g., PBR is not calculated for AMLR stocks, and strategic designations are not made). Extralimital species in the ARA include the pygmy right whale (*Caperea marginata*), sei whale, Cuvier's beaked whale, Shepherd's beaked whale (*Tasmacetus shepherdii*), Gray's beaked whale (*Mesoplodon grayi*), and strap-toothed beaked whale (*M. layardii*), which have distributions that only border the northernmost edge of the ARA. The Ross seal (*Ommatophoca rossii*) is also considered extralimital to the ARA due to its preference for dense pack ice, which is not typically present in the ARA.

Table 5. Marine mammals potentially present in the vicinity of SWFSC research activities in the AMLR

Common name	Scientific name	Stock ²	ESA/ MMPA status ³	Abundance (CV) ⁴
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)				
Family Balaenidae (right whales)				
Southern right whale	<u><i>Eubalaena australis</i></u>		E/D/LC	1,755 (0.62) ⁵

Family Balaenopteridae (rorquals)				
Humpback whale	<u>Megaptera novaeangliae australis</u>		E/D/LC	9,484 (0.28) ⁵
Antarctic minke whale	<u>Balaenoptera bonaerensis</u>		-/DD	18,125 (0.28) ⁵
Fin whale	<u>B. physalus quoyi</u>		E/D/EN	4,672 (0.42) ⁵
Blue whale	<u>B. musculus intermedia</u>		E/D/EN	1,700 (95% CI 860-2,900) ⁶
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)				
Family Physeteridae				
Sperm whale	<u>Physeter macrocephalus</u>		E/D/VU	12,069 (0.17) ⁷
Family Ziphiidae (beaked whales)				
Arnoux' beaked whale	<u>Berardius arnuxii</u>		-/DD	Unknown
Southern bottlenose whale	<u>Hyperoodon planifrons</u>		-/LC	53,743 (0.12) ⁸
Family Delphinidae				
Hourglass dolphin	<u>Lagenorhynchus cruciger</u>		-/LC	144,300 (0.17) ⁹
Killer whale	<u>Orcinus orca</u> ¹		-/DD	24,790 (0.23) ⁸
Long-finned pilot whale	<u>Globicephala melas edwardii</u>		-/DD	200,000 (0.35) ⁹
Family Phocoenidae (porpoises)				
Spectacled porpoise	<u>Phocoena dioptrica</u>		-/DD	Unknown
Order Carnivora – Superfamily Pinnipedia				
Family Otariidae (eared seals and sea lions)				
Antarctic fur seal	<u>Arctocephalus gazella</u>	South Georgia	-/LC	2,700,000 ¹⁰
Family Phocidae (earless seals)				
Southern elephant seal	<u>Mirounga leonina</u>	South Georgia	-/LC	401,572 ¹¹
Weddell seal	<u>Leptonychotes weddellii</u>		-/LC	500,000-1,000,000 ¹²
Crabeater seal	<u>Lobodon carcinophaga</u>		-/LC	5,000,000-10,000,000 ¹²
Leopard seal	<u>Hydrurga leptonyx</u>		-/LC	222,000-440,000 ¹²

¹Three distinct forms of killer whale have been described from Antarctic waters; referred to as types A, B, and C, they are purported prey specialists on Antarctic minke whales, seals, and fish, respectively (Pitman and Ensor, 2003).

²For most species in the AMLR, stocks are not delineated and entries refer generally to individuals of the species occurring in the ARA.

³Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Any species listed under the ESA is automatically designated under the MMPA as depleted. IUCN status: Endangered (EN), Vulnerable (VU), Least Concern (LC), Data Deficient (DD).

⁴CV is coefficient of variation. All abundance estimates, except for those from Reilly *et al.* (2004) (right, humpback, minke, and fin whales), are for entire Southern Ocean (i.e., waters south of 60°S) and not the smaller area comprising the SWFSC ARA.

⁵Abundance estimates reported in Reilly *et al.* (2004) for the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) survey area from 2000. Surveys include Antarctic Peninsula (473,300 km²) and Scotia Sea (1,109,800 km²) strata, which correspond roughly to ARA, as reported by Hewitt *et al.* (2004).

⁶Southern Ocean abundance estimate (Branch *et al.*, 2007). CI is confidence interval.

⁷Southern Ocean abundance estimate (IWC, 2001 in Whitehead, 2002).

⁸Southern Ocean abundance estimate from circumpolar surveys covering 68 percent of waters south of 60°S from 1991-98 (Branch and Butterworth, 2001).

⁹Southern Ocean abundance estimate derived from surveys conducted from 1976-88 (Kasamatsu and Joyce, 1995).

¹⁰South Georgia abundance estimate; likely >95 percent of range-wide abundance (Forcada and Staniland, 2009). Genetic evidence shows two distinct population regions, likely descended from surviving post-sealing populations at South Georgia,

Bouvetøya, and Kerguelen Islands (Wynen *et al.*, 2000; Forcada and Staniland, 2009). Individuals from the South Georgia population (including breeding populations at the South Orkney and South Shetland Islands, which are within the ARA) are likely to occur in the ARA.

¹¹Four genetically distinct populations are recognized: the Peninsula Valdés population in Argentina, the South Georgia population in the South Atlantic Ocean, the Kerguelen population in the South Indian Ocean and the Macquarie population in the South Pacific Ocean (Slade *et al.*, 1998; Hoelzel *et al.*, 2001). Animals occurring in ARA are likely to belong to South Georgia population, which includes subpopulations at South Georgia Island (>99% of population) and at the South Orkney and South Shetland Islands; South Georgia population abundance estimate from 2001 (McMahon *et al.*, 2005).

¹²Range-wide abundance estimates (Thomas and Terhune, 2009; Bengtson, 2009; Rogers, 2009).

Potential Effects of the Specified Activity on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity (e.g., gear deployment, use of active acoustic sources, visual disturbance) may impact marine mammals and their habitat. The “Estimated Take by Incidental Harassment” section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The “Negligible Impact Analysis” section will include an analysis of how this specific activity will impact marine mammals and will consider the content of this section, the “Estimated Take by Incidental Harassment” section, and the “Proposed Mitigation” section, to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals and from that on the affected marine mammal populations or stocks. In the following discussion, we consider potential effects to marine mammals from ship strike, physical interaction with the gear types described previously, use of active acoustic sources, and visual disturbance of pinnipeds.

Ship Strike

Vessel collisions with marine mammals, or ship strikes, can result in death or serious injury of the animal. Wounds resulting from ship strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface may be struck directly by a vessel, a surfacing animal may hit the bottom of a vessel, or an animal just below the surface may be cut by a vessel’s propeller. More superficial strikes

may not kill or result in the death of the animal. These interactions are typically associated with large whales (e.g., fin whales), which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans or pinnipeds are more maneuverable in relation to large vessels than are large whales, they may also be susceptible to strike. The severity of injuries typically depends on the size and speed of the vessel, with the probability of death or serious injury increasing as vessel speed increases (Knowlton and Kraus, 2001; Laist et al., 2001; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber et al., 2010; Gende et al., 2011).

Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 kn, and exceeded ninety percent at 17 kn. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death through increased likelihood of collision by pulling whales toward the vessel (Clyne, 1999; Knowlton et al., 1995). In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 kn. The chances of a lethal injury decline from approximately eighty percent at 15 kn to approximately twenty percent at 8.6 kn. At speeds below 11.8 kn, the chances of lethal injury drop below fifty percent, while the probability asymptotically increases toward one hundred percent above 15 kn.

In an effort to reduce the number and severity of strikes of the endangered North Atlantic right whale (Eubalaena glacialis), NMFS implemented speed restrictions in 2008 (73 FR 60173;

October 10, 2008). These restrictions require that vessels greater than or equal to 65 ft (19.8 m) in length travel at less than or equal to 10 kn near key port entrances and in certain areas of right whale aggregation along the U.S. eastern seaboard. Conn and Silber (2013) estimated that these restrictions reduced total ship strike mortality risk levels by eighty to ninety percent.

For vessels used in SWFSC research activities, transit speeds average 10 kn (but vary from 6-14 kn), while vessel speed during active sampling is typically only 2-4 kn. At sampling speeds, both the possibility of striking a marine mammal and the possibility of a strike resulting in serious injury or mortality are discountable. At average transit speed, the probability of serious injury or mortality resulting from a strike is less than fifty percent. However, the likelihood of a strike actually happening is again discountable. Ship strikes, as analyzed in the studies cited above, generally involve commercial shipping, which is much more common in both space and time than is research activity. Jensen and Silber (2004) summarized ship strikes of large whales worldwide from 1975-2003 and found that most collisions occurred in the open ocean and involved large vessels (e.g., commercial shipping). Commercial fishing vessels were responsible for three percent of recorded collisions, while only one such incident (0.75 percent) was reported for a research vessel during that time period.

It is possible for ship strikes to occur while traveling at slow speeds. For example, a NOAA-chartered survey vessel traveling at low speed (5.5 kn) while conducting multi-beam mapping surveys off the central California coast struck and killed a blue whale in 2009. The State of California determined that the whale had suddenly and unexpectedly surfaced beneath the hull, with the result that the propeller severed the whale's vertebrae, and that this was an unavoidable event. This strike represents the only such incident in approximately 540,000 hours of similar coastal mapping activity ($p = 1.9 \times 10^{-6}$; 95% CI = $0-5.5 \times 10^{-6}$; NMFS, 2013). In

addition, a research vessel reported a fatal strike in 2011 of a dolphin in the Atlantic, demonstrating that it is possible for strikes involving smaller cetaceans or pinnipeds to occur. In that case, the incident report indicated that an animal apparently was struck by the vessel's propeller as it was intentionally swimming near the vessel. While indicative of the type of unusual events that cannot be ruled out, neither of these instances represents a circumstance that would be considered reasonably foreseeable or that would be considered preventable.

In summary, we anticipate that vessel collisions involving SWFSC research vessels, while not impossible, represent unlikely, unpredictable events for which there are no preventive measures. No ship strikes have been reported from any fisheries research activities conducted or funded by the SWFSC in any of the three research areas. Given the relatively slow speeds of research vessels, the presence of bridge crew watching for obstacles at all times (including marine mammals), the presence of marine mammal observers on some surveys, and the small number of research cruises, we believe that the possibility of ship strike is discountable and, further, that were a strike of a large whale to occur, it would be unlikely to result in serious injury or mortality. No incidental take resulting from ship strike is anticipated, and this potential effect of research will not be discussed further in the following analysis.

Research Gear

The types of research gear used by SWFSC were described previously under "Detailed Description of Activity." Here, we broadly categorize these gears into those whose use we consider to have extremely unlikely potential to result in marine mammal interaction and those whose use we believe may result in marine mammal interaction. Gears in the former category are not considered further, while those in the latter category are carried forward for further analysis. Gears with likely potential for marine mammal interaction include midwater trawls, used in the

CCE only, and pelagic longlines, used in the CCE and ETP. Bottom trawls, used in the AMLR only, and bottom longlines, used in the CCE only, are not considered to have the likely potential for marine mammal interaction and are addressed in the general trawl and longline sections below.

Trawl nets and longline gears deployed by SWFSC are similar to gear used in various commercial fisheries, and the potential for and history of marine mammal interaction with these gears through physical contact (i.e., capture or entanglement) is well-documented. Read [et al.](#) (2006) estimated marine mammal bycatch in U.S. fisheries from 1990-99 and derived an estimate of global marine mammal bycatch by expanding U.S. bycatch estimates using data on fleet composition from the United Nations Food and Agriculture Organization (FAO). Although most U.S. bycatch for both cetaceans (84 percent) and pinnipeds (98 percent) occurred in gillnets (a gear type not used by SWFSC), global marine mammal bycatch in trawl nets and longlines is likely substantial given that total global bycatch is thought to number in the hundreds of thousands of individuals (Read [et al.](#), 2006). In addition, global bycatch via longline has likely increased, as longlines have become the most common method of capturing swordfish and tuna since the U.N. banned the use of high seas driftnets over 2.5 km long in 1991 (high seas driftnets were previously often 40-60 km long) (Read, 2008; FAO, 2001).

Marine mammals are widely regarded as being quite intelligent and inquisitive, and when their pursuit of prey coincides with human pursuit of the same resources, it should be expected that physical interaction with fishing gear may occur (e.g., Beverton, 1985). Fishermen and marine mammals are both drawn to areas of high prey density, and certain fishing activities may further attract marine mammals by providing food (e.g., bait, captured fish, bycatch discards) or by otherwise making it easier for animals to feed on a concentrated food source. Provision of

foraging opportunities near the surface may present an advantage by negating the need for energetically expensive deep foraging dives (Hamer and Goldsworthy, 2006). Trawling, for example, can make available previously unexploited food resources by gathering prey that may otherwise be too fast or deep for normal predation, or may concentrate calories in an otherwise patchy landscape (Fertl and Leatherwood, 1997). Pilot whales, which are generally considered to be teuthophagous (i.e., feeding primarily on squid), were commonly observed in association with Atlantic mackerel (Scomber scombrus) trawl fisheries from 1977-88 in the northeast U.S. EEZ (Waring et al., 1990). Not surprisingly, stomach contents of captured whales were observed to have high proportions of mackerel (68 percent of non-trace food items), indicating that the ready availability of a novel, concentrated, high-calorie prey item resulted in changed dietary composition (Read, 1994).

These interactions can result in injury or death for the animal(s) involved and/or damage to fishing gear. Coastal animals, including various pinnipeds, bottlenose dolphins, and harbor porpoises, are perhaps the most vulnerable to these interactions and set or passive fishing gear (e.g., gillnets, traps) the most likely to be interacted with (e.g., Beverton, 1985; Barlow et al., 1994; Read et al., 2006; Byrd et al., 2014). Although interactions are less common for use of trawl nets and longlines (gear used by SWFSC), they do occur with sufficient frequency to necessitate the establishment of required mitigation measures for multiple U.S. fisheries using both types of gear (NMFS, 2014). It is likely that no species of marine mammal can be definitively excluded from the potential for interaction with fishing gear (e.g., Northridge, 1984); however, the extent of interactions is likely dependent on the biology, ecology, and behavior of the species involved and the type, location, and nature of the fishery.

Trawl nets – As described previously, trawl nets are towed nets (i.e., active fishing) consisting of a cone-shaped net with a codend or bag for collecting the fish and can be designed to fish at the bottom, surface, or any other depth in the water column. Here we refer to bottom trawls and midwater trawls (i.e., any net not designed to tend the bottom while fishing). Trawl nets in general have the potential to capture or entangle marine mammals, which have been known to be caught in bottom trawls, presumably when feeding on fish caught therein, and in midwater trawls, which may or may not be coincident with their feeding (Northridge, 1984).

Capture or entanglement may occur whenever marine mammals are swimming near the gear, intentionally (e.g., foraging) or unintentionally (e.g., migrating), and any animal captured in a net is at significant risk of drowning unless quickly freed. Animals can also be captured or entangled in netting or tow lines (also called lazy lines) other than the main body of the net; animals may become entangled around the head, body, flukes, pectoral fins, or dorsal fin. Interaction that does not result in the immediate death of the animal by drowning can cause injury (i.e., Level A harassment) or serious injury. Constricting lines wrapped around the animal can immobilize the animal or injure by cutting into or through blubber, muscles and bone (i.e., penetrating injuries) or constricting blood flow to or severing appendages. Immobilization of the animal, if it does not result in immediate drowning, can cause internal injuries from prolonged stress and/or severe struggling and/or impede the animal's ability to feed (resulting in starvation or reduced fitness) (Andersen et al., 2008).

Marine mammal interactions with trawl nets, through capture or entanglement, are well-documented. Dolphins are known to attend operating nets in order to either benefit from disturbance of the bottom or to prey on discards or fish within the net. For example, Leatherwood (1975) reported that the most frequently observed feeding pattern for bottlenose

dolphins in the Gulf of Mexico involved herds following working shrimp trawlers, apparently feeding on organisms stirred up from the benthos. Bearzi and di Sciara (1997) opportunistically investigated working trawlers in the Adriatic Sea from 1990-94 and found that ten percent were accompanied by foraging bottlenose dolphins. However, midwater trawls have greater potential to capture cetaceans, because the nets may be towed at faster speeds, these trawls are more likely to target species that are important prey for marine mammals (e.g., squid, mackerel), and the likelihood of working in deeper waters means that a more diverse assemblage of species could potentially be present (Hall et al., 2000).

Globally, at least seventeen cetacean species are known to feed in association with trawlers and individuals of at least 25 species are documented to have been killed by trawl nets, including several large whales, porpoises, and a variety of delphinids (Karpouzli and Leaper, 2004; Hall et al., 2000; Fertl and Leatherwood, 1997; Northridge, 1991). At least eighteen species of seals and sea lions are known to have been killed in trawl nets (Wickens, 1995). Generally, direct interaction between trawl nets and marine mammals (both cetaceans and pinnipeds) has been recorded wherever trawling and animals co-occur. Tables 6 and 7 display records of interactions between marine mammals and trawl nets by taxonomy and geography; please note that this should not be considered exhaustive. A lack of recorded interactions where animals are present may indicate that trawling is absent or an insignificant component of fisheries in that region or that interactions were not observed, recorded, or reported.

Table 6. Taxonomic and geographic distribution of cetacean-trawl interactions. Please see footnotes below Table 7.

Cetaceans	NW ATL	NE ATL	WC ATL	EC ATL	M E D	SW ATL	SE ATL	I N D	NW PAC	NE PAC	WC PAC	EC PAC	SW PAC	SE PAC
Humpback whale	X									X				
Baleen whales (<u>Balaenoptera</u> spp.)	X								X	X				
Baleen whale (unid.)	X	X								X				

Sperm whale					X									
Beaked whale (unid.)													X	
Franciscana (<i>Pontoporia blainvillei</i>)						X								
Dolphins (<i>Cephalorhynchus</i> spp.)						X	X						X	X
Rough-toothed dolphin												X		
Dolphins (<i>Tursiops</i> spp.)	X	X	X	X	X	X		X	X			X	X	
Dolphins (<i>Stenella</i> spp.)	X	X	X	X	X			X			X	X		
Dolphins (<i>Delphinus</i> spp.)	X	X		X	X	X	X					X	X	
Fraser's dolphin												X		
Dolphins (<i>Lagenorhynchus</i> spp.)	X	X				X	X		X	X		X	X	
Risso's dolphin	X	X	X				X			X		X		
False killer whale									X					
Killer whale										X			X	
Pilot whale (<i>Globicephala</i> spp.)	X	X	X	X		X						X	X	
Finless porpoise (<i>Neophocaena</i> spp.)								X	X		X			
Porpoises (<i>Phocoena</i> spp.)	X	X			X	X				X		X		
Dall's porpoise										X		X		

Table 7. Taxonomic and geographic distribution of pinniped-trawl interactions.

Pinnipeds	NW ATL	NE ATL	NE PAC	NW PAC	S PAC/ ATL	S ATL/ IND	S IND/ PAC
Fur seals (<i>Arctocephalus</i> spp.)					X	X	X
Northern fur seal			X	X			
California sea lion			X				
Steller sea lion			X	X			
Australian sea lion (<i>Neophoca cinerea</i>)							X
New Zealand sea lion (<i>Phocarctos hookeri</i>)							X
South American sea lion					X		
Bearded seal (<i>Erignathus barbatus</i>)			X				
Seals (<i>Phoca</i> spp.)	X	X	X				
Ringed seal (<i>Pusa hispida</i>)			X				
Gray seal (<i>Halichoerus grypus</i>)	X	X					
Ribbon seal (<i>Histiophoca fasciata</i>)			X				
Harp seal (<i>Pagophilus groenlandicus</i>)	X	X					
Northern elephant seal			X				
Mediterranean monk seal (<i>Monachus monachus</i>)		X					

Sources: Northridge, 1984, 1991; Wickens, 1995; Fertl and Leatherwood, 1997; Perez, 2006; Zeeberg *et al.*, 2006; Young and Iudicello, 2007; Song *et al.*, 2010.

Geography: NW, NE, SW, SE refer to ordinal directions. WC/EC refer to eastern or western central. ATL = Atlantic; PAC = Pacific; IND = Indian; MED = Mediterranean. Geographical regions follow Northridge (1984) and Wickens (1995) for cetaceans and pinnipeds, respectively. Southern hemisphere geography differs for pinnipeds to better reflect distribution around mainland sites in South America, Africa, Australia, and New Zealand. There are very few records of interactions in the Southern Ocean (e.g., fur seals entangled in krill trawls; Hooper *et al.*, 2005); therefore, this location was omitted from the tables.

Taxonomy: Species are grouped by genus where possible. Shaded boxes indicate the genus or species is not present in that geographic region. There are numerous records of interactions with unidentified cetaceans and pinnipeds.

Tables 6 and 7 are intended to illustrate the general vulnerability of marine mammals to interaction with trawl nets, without considering the specific type of net or the manner in which that risk may be mitigated. Some of the records supporting development of these tables are from discontinued fisheries or from fisheries where management measures have subsequently mitigated the risk of interaction to a substantial degree. Table 13 (below) displays more recent information regarding interactions specifically in U.S. fisheries and is more relevant to the development of take estimates for this proposed rule. In evaluating risk relative to a specific fishery (or comparable research survey), one must consider the size of the net as well as frequency, timing, and location of deployment. These considerations inform determinations of whether interaction with marine mammals is likely.

Of the three net types described previously under “Trawl Nets”, SWFSC has recorded marine mammal interactions with both midwater nets (NETS Nordic 264 and modified Cobb), which are used only in the CCE. No marine mammal interactions have been recorded for the bottom trawl (NETS Hard-Bottom Snapper Trawl), which is deployed only in the Antarctic. While a lack of historical interactions does not in and of itself indicate that future interactions are unlikely, we believe that the historical record for SWFSC operations in AMLR, considered in context with the frequency and timing of these bottom trawl surveys, as well as mitigation measures employed provide substantial support for a determination that future marine mammal

interactions with this gear are extremely unlikely. In addition, as described above, bottom trawls generally involve less risk of interaction than do midwater trawls.

Incidental takes of fur seals have been documented in Antarctic krill fisheries using midwater trawls (Hooper et al., 2005) and rarely in demersal trawls for Patagonian toothfish (Dissostichus eleginoides) near Australian subantarctic islands (Wienecke and Robertson, 2002), but there are no documented takes of any species in any other gear by U.S. vessels in the region. We are not aware of any such takes in bottom trawls deployed anywhere in Antarctic waters. Further, fisheries using bottom trawl gear are known to typically interact with cetaceans such as porpoises and bottlenose dolphins, which are not present in the AMLR. SWFSC researchers conduct visual and acoustic surveys prior to deploying bottom trawl gear to assess the bathymetry and whether marine mammals are present in the area; these surveys have resulted in very few detections of marine mammals during trawling operations, indicating that there is likely little spatio-temporal overlap between bottom trawl surveys and significant densities of marine mammals. This survey is conducted infrequently – only every two to three years – and at low volume relative to similar commercial fisheries, involving approximately one hundred tows of thirty-minutes each when it does occur. SWFSC use of bottom trawl nets, which are deployed only in AMLR, is not discussed further in this document.

Longlines – Longlines are basically strings of baited hooks that are either anchored to the bottom, for targeting groundfish, or are free-floating, for targeting pelagic species and represent a passive fishing technique. Pelagic longlines, which notionally fish near the surface with the use of floats, may be deployed in such a way as to fish at different depths in the water column. For example, deep-set longlines targeting tuna may have a target depth of 400 m, while a shallow-set longline targeting swordfish is set at 30-90 m depth. We refer here to bottom and pelagic

longlines. Any longline generally consists of a mainline from which leader lines (gangions) with baited hooks branch off at a specified interval, and is left to passively fish, or soak, for a set period of time before the vessel returns to retrieve the gear. Longlines are marked by two or more floats that act as visual markers and may also carry radio beacons; aids to detection are of particular importance for pelagic longlines, which may drift a significant distance from the deployment location. Pelagic longlines are generally composed of various diameter monofilament line and are generally much longer, and with more hooks, than are bottom longlines. Bottom longlines may be of monofilament or multifilament natural or synthetic lines.

Marine mammals may be hooked or entangled in longline gear, with interactions potentially resulting in death due to drowning, strangulation, severing of carotid arteries or the esophagus, infection, an inability to evade predators, or starvation due to an inability to catch prey (Hofmeyr et al., 2002), although it is more likely that animals will survive being hooked if they are able to reach the surface to breathe. Injuries, which may include serious injury, include lacerations and puncture wounds. Animals may attempt to depredate either bait or catch, with subsequent hooking, or may become accidentally entangled. As described for trawls, entanglement can lead to constricting lines wrapped around the animals and/or immobilization, and even if entangling materials are removed the wounds caused may continue to weaken the animal or allow further infection (Hofmeyr et al., 2002). Large whales may become entangled in a longline and then break free with a portion of gear trailing, resulting in alteration of swimming energetics due to drag and ultimate loss of fitness and potential mortality (Andersen et al., 2008). Weight of the gear can cause entangling lines to further constrict and further injure the animal. Hooking injuries and ingested gear are most common in small cetaceans and pinnipeds, but have been observed in large cetaceans (e.g., sperm whales). The severity of the injury depends on the

species, whether ingested gear includes hooks, whether the gear works its way into the gastrointestinal (GI) tract, whether the gear penetrates the GI lining, and the location of the hooking (e.g., embedded in the animal's stomach or other internal body parts) (Andersen *et al.*, 2008). Bottom longlines pose less of a threat to marine mammals due to their deployment on the ocean bottom, but can still result in entanglement in buoy lines or hooking as the line is either deployed or retrieved. The rate of interaction between longline fisheries and marine mammals depends on the degree of overlap between longline effort and species distribution, hook style and size, type of bait and target catch, and fishing practices (such as setting/hauling during the day or at night).

Tables 8 and 9 display records of interactions between marine mammals and longlines by taxonomy and geography; please note this should not be considered exhaustive. A lack of recorded interactions where animals are present may indicate that longlining is absent or an insignificant component of fisheries in that region or that interactions were not observed, recorded, or reported.

Table 8. Taxonomic and geographic distribution of cetacean-longline interactions. Please see footnotes below Table 9.

Cetaceans	NW ATL	NE ATL	WC ATL	EC ATL	M E D	SW ATL	SE ATL	I N D	NW PAC	NE PAC	WC PAC	EC PAC	SW PAC	SE PAC
Humpback whale	X									X				
Fin whale					X									
Sperm whale					X					X				X
Cuvier's beaked whale					X									
Ginkgo-toothed beaked whale											X			
Rough-toothed dolphin												X		
Dolphins (<i>Tursiops</i> spp.)	X				X							X		
Dolphins (<i>Stenella</i> spp.)			X		X							X		
Dolphins (<i>Delphinus</i> spp.)		X	X									X		
Fraser's dolphin												X		
Dolphins (<i>Lagenorhynchus</i> spp.)	X					X			X	X		X		

Risso's dolphin			X		X				X			X		
False killer whale	X		X		X						X	X		
Killer whale			X					X		X				
Pilot whale (<i>Globicephala</i> spp.)	X	X	X			X						X		
Porpoises (<i>Phocoena</i> spp.)		X							X					
Dall's porpoise												X		

Table 9. Taxonomic and geographic distribution of pinniped-longline interactions.

Pinnipeds	NW ATL	NE ATL	NE PAC	NW PAC	S PAC/ ATL	S ATL/ IND	S IND/ PAC	S. Ocean
Fur seals (<i>Arctocephalus</i> spp.)							X	X
Northern fur seal								
California sea lion								
Steller sea lion			X					
Seals (<i>Phoca</i> spp.)	X							
Ribbon seal (<i>Histiophoca fasciata</i>)			X					
Harp seal (<i>Pagophilus</i> <i>groenlandicus</i>)		X						
Hooded seal (<i>Cystophora cristata</i>)		X						
Northern elephant seal								X
Monk seals (<i>Monachus</i> / <i>Neomonachus</i>)		X	X					

Sources: Northridge, 1984, 1991; Wickens, 1995; Perez, 2006; Young and Iudicello, 2007.

Geography: NW, NE, SW, SE refer to ordinal directions. WC/EC refer to eastern or western central. ATL = Atlantic; PAC = Pacific; IND = Indian; MED = Mediterranean. Geographical regions follow Northridge (1984) and Wickens (1995) for cetaceans and pinnipeds, respectively. Southern hemisphere geography differs for pinnipeds to better reflect distribution around mainland sites in South America, Africa, Australia, and New Zealand.

Taxonomy: Species are grouped by genus where possible. Shaded boxes indicate the genus or species is not present in that geographic region. There are numerous records of interactions with unidentified cetaceans and pinnipeds.

Tables 8 and 9 are intended to illustrate the general vulnerability of marine mammals to interaction with longlines, without considering the specific type of gear or the manner in which that risk may be mitigated. Some of the records supporting development of these tables are from discontinued fisheries or from fisheries where management measures have subsequently mitigated the risk of interaction to a substantial degree. Table 13 (see “Estimated Take Due to Gear Interaction”) displays more recent information regarding interactions specifically in U.S. fisheries and is more relevant to the development of take estimates for this proposed rule. In evaluating risk relative to a specific fishery (or research survey), one must consider the length of

the line and number of hooks deployed as well as frequency, timing, and location of deployment. These considerations inform determinations of whether interaction with marine mammals is likely.

SWFSC has recorded marine mammal interactions with traditional pelagic longlines, which are used in the CCE and planned for use in the ETP, but not with vertical pelagic longlines or with bottom longlines (CCE only). While a lack of historical interactions does not in and of itself indicate that future interactions are unlikely, we believe that the historical record, considered in context with the frequency and timing of these activities, as well as mitigation measures employed provide substantial support for a determination that future marine mammal interactions with these gears are extremely unlikely. In addition, as described above, bottom longlines generally involve less risk of interaction than do pelagic longlines.

Vertical longline gear, planned for use in the deep-set buoy gear surveys, is similar to gear used in the Atlantic, and there are no recorded marine mammal interactions in either location. The only known U.S. fishery using similar gear is the Hawaii vertical longline fishery, which has nine participants (meaning there is likely greater effort than the minimal 54 sets and 2,200 hook hours logged by SWFSC), and is categorized as a Category III fishery (i.e., remote likelihood of or no known M/SI) with no documented incidental M/SI. The gear has been designed specifically to eliminate protected species interactions, with minimal visual and/or sensory attractants to the gear in the upper water column (e.g., no surface chumming or offal discharge, no visual cues from multiple hooks that are sinking to depth slowly), and with a single weighted monofilament line with virtually no slack or sag. These features minimize the risk of hooking or entanglement.

The SWFSC deploys bottom longlines at an extremely limited scale for one survey (Sablefish Life History) in one location (near Bodega Bay in central California). The survey is conducted once per month, with approximately two to three sets of 75 hooks each per trip (approximately two hundred hooks per month). Commercial fisheries involving bottom longlines that have documented incidental M/SI operate at much larger spatio-temporal scales with much greater hook hours than this survey, which we consider de minimis. Neither vertical longlines nor bottom longlines are discussed further in this document.

Other research gear – The only SWFSC research gears with any record of marine mammal interactions are midwater trawls (NETS Nordic 264 and modified-Cobb) and pelagic longline gear. Bottom trawls and other types of longlines were discussed in the preceding sections. All other gears used in SWFSC fisheries research (e.g., a variety of plankton nets, CTDs, ROVs) do not have the expected potential for marine mammal interactions, and are not known to have been involved in any marine mammal interaction anywhere. Specifically, we consider CTDs, XBTs, CUFES, ROVs, small trawls (Oozeki, IKMT, MOCNESS, and Tucker trawls), plankton nets (Bongo, Paironet, and Manta nets), and vertically deployed or towed imaging systems to be no-impact gear types.

Unlike trawl nets and longline gear, which are used in both scientific research and commercial fishing applications, these other gears are not considered similar or analogous to any commercial fishing gear and are not designed to capture any commercially salable species, or to collect any sort of sample in large quantities. They are not considered to have the potential to take marine mammals primarily because of their design how they are deployed. For example, CTDs are typically deployed in a vertical cast on a cable and have no loose lines or other entanglement hazards. A Bongo net is typically deployed on a cable, whereas neuston nets (these

may be plankton nets or small trawls) are often deployed in the upper one meter of the water column; either net type has very small size (e.g., two bongo nets of 0.5 m² each or a neuston net of approximately 2 m²) and no trailing lines to present an entanglement risk. These other gear types are not considered further in this document.

Acoustic Effects

We previously provided general background information on sound and the specific sources used by the SWFSC (see “Description of Active Acoustic Sound Sources”). Here, we first provide background information on marine mammal hearing before discussing the potential effects of SWFSC use of active acoustic sources on marine mammals.

Marine mammal hearing – Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (e.g., Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for low-frequency cetaceans. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- Low-frequency cetaceans (mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 25 kHz (up to 30 kHz in some species), with best hearing estimated to be from 100 Hz to 8 kHz (Watkins, 1986; Ketten, 1998; Houser et al., 2001; Au et al., 2006; Lucifredi and Stein, 2007; Ketten et al., 2007; Parks et al., 2007a; Ketten and Mountain, 2009; Tubelli et al., 2012);
- Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz, with best hearing from 10 to less than 100 kHz (Johnson, 1967; White, 1977; Richardson et al., 1995; Szymanski et al., 1999; Kastelein et al., 2003; Finneran et al., 2005a, 2009; Nachtigall et al., 2005, 2008; Yuen et al., 2005; Popov et al., 2007; Au and Hastings, 2008; Houser et al., 2008; Pacini et al., 2010, 2011; Schlundt et al., 2011);
- High-frequency cetaceans (porpoises, river dolphins, and members of the genera Kogia and Cephalorhynchus; including two members of the genus Lagenorhynchus, including the hourglass dolphin, on the basis of recent echolocation data and genetic data [May-Collado and Agnarsson, 2006; Kyhn et al. 2009, 2010; Tougaard et al. 2010]): functional hearing is estimated to occur between approximately 200 Hz and 180 kHz (Popov and Supin, 1990a,b; Kastelein et al., 2002; Popov et al., 2005); and
- Pinnipeds in water; Phocidae (true seals): functional hearing is estimated to occur between approximately 75 Hz to 100 kHz, with best hearing between 1-50 kHz (Møhl, 1968; Terhune and Ronald, 1971, 1972; Richardson et al., 1995; Kastak and Schusterman, 1999; Reichmuth, 2008; Kastelein et al., 2009);
- Pinnipeds in water; Otariidae (eared seals): functional hearing is estimated to occur between 100 Hz and 40 kHz for Otariidae, with best hearing between 2-48 kHz

(Schusterman et al., 1972; Moore and Schusterman, 1987; Babushina et al., 1991; Richardson et al., 1995; Kastak and Schusterman, 1998; Kastelein et al., 2005a; Mulsow and Reichmuth, 2007; Mulsow et al., 2011a, b).

The pinniped functional hearing group was modified from Southall et al. (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä et al., 2006; Kastelein et al., 2009; Reichmuth et al., 2013).

Within the CCE, 34 marine mammal species (28 cetacean and six pinniped [four otariid and two phocid] species) have the potential to co-occur with SWFSC research activities. Please refer to Tables 3-5. Of the 28 cetacean species that may be present, six are classified as low-frequency cetaceans (i.e., all mysticete species), eighteen are classified as mid-frequency cetaceans (i.e., all delphinid and ziphiid species and the sperm whale), and four are classified as high-frequency cetaceans (i.e., porpoises and Kogia spp.). Within the ETP, 32 marine mammal species (28 cetacean and four pinniped [three otariid and one phocid] species) have the potential to co-occur with SWFSC research activities. Of the 28 cetacean species that may be present, six are classified as low-frequency cetaceans (i.e., all mysticete species), 21 are classified as mid-frequency cetaceans (i.e., all delphinid and ziphiid species and the sperm whale), and one is classified as a high-frequency cetacean (i.e., dwarf sperm whale). Within the AMLR, seventeen marine mammal species (twelve cetacean and five pinniped [one otariid and four phocid] species) have the potential to co-occur with SWFSC research activities. Of the twelve cetacean species that may be present, five are classified as low-frequency cetaceans (i.e., all mysticete species), five are classified as mid-frequency cetaceans (i.e., all delphinid and ziphiid species

[excluding the hourglass dolphin] and the sperm whale), and two are classified as high-frequency cetaceans (i.e., the hourglass dolphin and spectacled porpoise).

Potential effects of underwater sound – Please refer to the information given previously (“Description of Active Acoustic Sources”) regarding sound, characteristics of sound types, and metrics used in this document. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson et al., 1995; Gordon et al., 2004; Nowacek et al., 2007; Southall et al., 2007; Götz et al., 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds.

Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal’s hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to SWFSC’s use of active acoustic sources (e.g., echosounders).

Richardson et al. (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal’s hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third

is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (i.e., when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (i.e., permanent hearing impairment, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that SWFSC use of active acoustic sources may result in such effects (see below for further discussion). Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak et al., 1999; Schlundt et al., 2000; Finneran et al., 2002, 2005b). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall et al., 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (i.e., tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall et al., 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (e.g., Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals – PTS data exists only for a single harbor seal (Kastak et al., 2008) – but are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above (a 40-dB threshold shift approximates PTS onset; e.g., Kryter et al., 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates TTS onset; e.g., Southall et al. 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall et al., 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (e.g., change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox et al., 2006; Southall et al., 2007; Zimmer and Tyack, 2007). SWFSC activities do not involve the use of devices such as explosives or mid-frequency active sonar that are associated with these types of effects.

When a live or dead marine mammal swims or floats onto shore and is incapable of returning to sea, the event is termed a “stranding” (16 U.S.C. 1421h(3)). Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxycosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or

combinations of these stressors sustained concurrently or in series (e.g., Geraci et al., 1999). However, the cause or causes of most strandings are unknown (e.g., Best, 1982). Combinations of dissimilar stressors may combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other would not be expected to produce the same outcome (e.g., Sih et al., 2004). For further description of stranding events see, e.g., Southall et al., 2006; Jepson et al., 2013; Wright et al., 2013.

1. Temporary threshold shift – TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the data published at the time of this writing concern TTS elicited by exposure to multiple pulses of sound.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (i.e., recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained

during time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale [Delphinapterus leucas], harbor porpoise, and Yangtze finless porpoise [Neophocoena asiaeorientalis]) and three species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (i.e., mostly tones and octave-band noise) in laboratory settings (e.g., Finneran et al., 2002; Nachtigall et al., 2004; Kastak et al., 2005; Lucke et al., 2009; Popov et al., 2011). In general, harbor seals (Kastak et al., 2005; Kastelein et al., 2012a) and harbor porpoises (Lucke et al., 2009; Kastelein et al., 2012b) have a lower TTS onset than other measured pinniped or cetacean species. Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall et al. (2007) and Finneran and Jenkins (2012).

2. Behavioral effects – Behavioral disturbance may include a variety of effects, including subtle changes in behavior (e.g., minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (e.g., species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (e.g., Richardson et al., 1995; Wartzok et al., 2003; Southall et al., 2007; Weilgart, 2007; Archer et al., 2010). Behavioral reactions can vary not only among individuals

but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison et al., 2012), and can vary depending on characteristics associated with the sound source (e.g., whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B-C of Southall et al. (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al., 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder et al., 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson et al., 1995; NRC, 2003; Wartzok et al., 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al., 1997; Finneran et al., 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson et al., 1995; Nowacek et al., 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (e.g., Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (e.g., Frankel and Clark, 2000; Costa et al., 2003; Ng and Leung, 2003; Nowacek et al.; 2004). Variations in dive behavior may reflect interruptions in biologically significant activities (e.g., foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (e.g., bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing

factors to differences in response in any given circumstance (e.g., Croll et al., 2001; Nowacek et al.; 2004; Madsen et al., 2006; Yazvenko et al., 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (e.g., Kastelein et al., 2001, 2005b, 2006; Gailey et al., 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller et al., 2000; Frstrup et al., 2003; Foote et al., 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased

anthropogenic noise (Parks et al., 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles et al., 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson et al., 1995). For example, gray whales are known to change direction – deflecting from customary migratory paths – in order to avoid noise from seismic surveys (Malme et al., 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (e.g., Bowles et al., 1994; Goold, 1996; Stone et al., 2000; Morton and Symonds, 2002; Gailey et al., 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (e.g., Blackwell et al., 2004; Bejder et al., 2006; Teilmann et al., 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (e.g., directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (i.e., when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (e.g., Beauchamp and Livoreil, 1997; Fritz et al., 2002; Purser and Radford, 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (e.g., decline in body condition) and subsequent reduction in reproductive success, survival, or both (e.g., Harrington and Veitch, 1992; Daan et al., 1996; Bradshaw et al., 1998). However, Ridgway et al. (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall et al., 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall et al., 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

3. Stress responses – An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (e.g., Seyle, 1950; Moberg, 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress – including immune competence, reproduction, metabolism, and behavior – are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (e.g., Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano et al., 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and “distress” is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (e.g., Holberton et al., 1996; Hood et al., 1998; Jessop et al., 2003; Krausman et al., 2004; Lankford et al., 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano et al., 2002b) and, more rarely, studied in wild populations (e.g., Romano et al., 2002a). For example, Rolland et al. (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as “distress.” In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

4. Auditory masking – Sound can disrupt behavior through masking, or interfering with, an animal’s ability to detect, recognize, or discriminate between acoustic signals of interest (e.g., those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson et al., 1995). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (e.g., snapping shrimp, wind, waves, precipitation) or anthropogenic (e.g., shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (e.g., signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal’s hearing abilities (e.g., sensitivity,

frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (e.g., Clark *et al.*, 2009) and may result in energetic or other costs as animals change their vocalization behavior (e.g., Miller *et al.*, 2000; Foote *et al.*, 2004; Parks *et al.*, 2007b; Di Iorio and Clark, 2009; Holt *et al.*, 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.*, 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014). Masking can be tested directly in captive species (e.g., Erbe, 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing

real-world masking sounds likely to be experienced by marine mammals in the wild (e.g., Branstetter et al., 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (e.g., from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Potential effects of SWFSC activity – As described previously (see “Description of Active Acoustic Sound Sources”), the SWFSC proposes to use various active acoustic sources, including echosounders (e.g., multibeam systems), scientific sonar systems, positional sonars (e.g., net sounders for determining trawl position), and environmental sensors (e.g., current profilers). These acoustic sources, which are present on most SWFSC fishery research vessels, include a variety of single, dual, and multi-beam echosounders (many with a variety of modes), sources used to determine the orientation of trawl nets, and several current profilers.

Many typically investigated acoustic sources (e.g., seismic airguns, low- and mid-frequency active sonar used for military purposes, pile driving, vessel noise) – sources for which certain of the potential acoustic effects described above have been observed or inferred – produce signals that are either much lower frequency and/or higher total energy (considering output sound levels and signal duration) than the high-frequency mapping and fish-finding systems used by the SWFSC. There has been relatively little attention given to the potential impacts of high-frequency sonar systems on marine life, largely because their combination of

high output frequency and relatively low output power means that such systems are less likely to impact many marine species. However, some marine mammals do hear and produce sounds within the frequency range used by these sources and ambient noise is much lower at high frequencies, increasing the probability of signal detection relative to other sounds in the environment.

As noted above, relatively high levels of sound are likely required to cause TTS in most pinnipeds and odontocete cetaceans. While dependent on sound exposure frequency, level, and duration, NMFS' acoustics experts believe that existing studies indicate that for the kinds of relatively brief exposures potentially associated with transient sounds such as those produced by the active acoustic sources used by the SWFSC, SPLs in the range of approximately 180-220 dB rms might be required to induce onset TTS levels for most species (SWFSC, 2013). However, it should be noted that there may be increased sensitivity to TTS for certain species generally (harbor porpoise; Lucke et al., 2009) or specifically at higher sound exposure frequencies, which correspond to a species' best hearing range (20 kHz vs. 3 kHz for bottlenose dolphins; Finneran and Schlundt, 2010). However, for these animals, which are better able to hear higher frequencies and may be more sensitive to higher frequencies, exposures on the order of approximately 170 dB rms or higher for brief transient signals are likely required for even temporary (recoverable) changes in hearing sensitivity that would likely not be categorized as physiologically damaging (SWFSC, 2013). The corresponding estimates for PTS would be at very high received levels that would rarely be experienced in practice.

Based on discussion provided by Southall et al. (2007), Lurton and DeRuiter (2011) modeled the potential impacts of conventional echosounders on marine mammals, estimating PTS onset at typical distances of 10-100 m for the kinds of sources considered here. Kremser et

al. (2005) modeled the potential for TTS in blue, sperm, and beaked whales (please see Kremser et al. [2005] for discussion of assumptions regarding TTS onset in these species) from a multibeam echosounder, finding similarly that TTS would likely only occur at very close ranges to the hull of the vessel. The authors estimated ship movement at 12 kn (faster than SWFSC vessels would typically move), which would result in an underestimate of the potential for TTS to occur, but the modeled system (Hydrosweep) operates at lower frequencies and with a wider beam pattern than do typical SWFSC systems, which would result in a likely more significant overestimate of TTS potential. The results of both studies emphasize that these effects would very likely only occur in the cone ensonified below the ship and that animal responses to the vessel (sound or physical presence) at these extremely close ranges would very likely influence their probability of being exposed to these levels. At the same distances, but to the side of the vessel, animals would not be exposed to these levels, greatly decreasing the potential for an animal to be exposed to the most intense signals. For example, Kremser et al. (2005) note that SPLs outside the vertical lobe, or beam, decrease rapidly with distance, such that SPLs within the horizontal lobes are about 20 dB less than the value found in the center of the beam. For certain species (i.e., odontocete cetaceans and especially harbor porpoises), these ranges may be somewhat greater based on more recent data (Lucke et al., 2009; Finneran and Schlundt, 2010) but are likely still on the order of hundreds of meters. In addition, potential behavioral responses further reduce the already low likelihood that an animal may approach close enough for any type of hearing loss to occur.

Various other studies have evaluated the environmental risk posed by use of specific scientific sonar systems. Burkhardt et al. (2007) considered both the Hydrosweep system evaluated by Kremser et al. (2005) and the Simrad EK60, which is used by the SWFSC, and

concluded that direct injury (i.e., sound energy causes direct tissue damage) and indirect injury (i.e., self-damaging behavior as response to acoustic exposure) would be unlikely given source and operational use (i.e., vessel movement) characteristics, and that any behavioral responses would be unlikely to be significant. Similarly, Boebel et al. (2006) considered the Hydrosweep system in relation to the risk for direct or indirect injury, concluding that (1) risk of TTS (please see Boebel et al. [2006] for assumptions regarding TTS onset) would be less than two percent of the risk of ship strike and (2) risk of behaviorally-induced damage would be essentially nil due to differences in source characteristics between scientific sonars and sources typically associated with stranding events (e.g., mid-frequency active sonar, but see discussion of Madagascar stranding event below). It should be noted that the risk of direct injury may be greater when a vessel operates sources while on station (i.e., stationary), as there is a greater chance for an animal to receive the signal when the vessel is not moving.

Boebel et al. (2005) report the results of a workshop in which a structured, qualitative risk analysis of a range of acoustic technology was undertaken, specific to use of such technology in the Antarctic. The authors assessed a single-beam echosounder commonly used for collecting bathymetric data (12 kHz, 232 dB, 10° beam width), an array of single-beam echosounders used for mapping krill (38, 70, 120, and 200 kHz; 230 dB; 7° beam width), and a multibeam echosounder (30 kHz, 236 dB, 150° x 1° swath width). For each source, the authors produced a matrix displaying the severity of potential consequences (on a six-point scale) against the likelihood of occurrence for a given degree of severity. For the former two systems, the authors determined on the basis of the volume of water potentially affected by the system and comparisons between its output and available TTS data that the chance of TTS is only in a small volume immediately under the transducers, and that consequences of level four and above were

inconceivable, whereas level one consequences (“Individuals show no response, or only a temporary (minutes) behavior change”) would be expected in almost all instances. Some minor displacement of animals in the immediate vicinity of the ship may occur. For the multibeam echosounder, Boebel et al. (2005) note that the high output and broad width of the swath abeam of the vessel makes displacement of animals more likely. However, the fore and aft beam width is small and the pulse length very short, so the risk of ensonification above TTS levels is still considered quite small and the likelihood of auditory or other injuries low. In general, the authors reached the same conclusions described for the single-beam systems, but note that more severe impacts – including fatalities resulting from herding of sensitive species in narrow sea ways – are at least possible (i.e., may occur in exceptional circumstances). However, the probability of herding remains low not just because of the rarity of the necessary confluence of species, bathymetry, and likely other factors, but because the restricted beam shape makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel (Boebel et al., 2005).

We have, however, considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from SWFSC use of the multibeam echosounder, on the basis of a 2008 mass stranding of approximately one hundred melon-headed whales in a Madagascar lagoon system. An investigation of the event indicated that use of a high-frequency mapping system (12-kHz multibeam echosounder; it is important to note that all SWFSC sources operate at higher frequencies [see Table 2]) was the most plausible and likely initial behavioral trigger of the event, while providing the caveat that there is no unequivocal and easily identifiable single cause (Southall et al., 2013). The panel’s conclusion was based on (1) very close temporal and spatial association and directed movement of the survey with the

stranding event; (2) the unusual nature of such an event coupled with previously documented apparent behavioral sensitivity of the species to other sound types (Southall et al., 2006; Brownell et al., 2009); and (3) the fact that all other possible factors considered were determined to be unlikely causes. Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying large areas of deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site; this may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system.

The investigatory panel systematically excluded or deemed highly unlikely nearly all potential reasons for these animals leaving their typical pelagic habitat for an area extremely atypical for the species (i.e., a shallow lagoon system). Notably, this was the first time that such a system has been associated with a stranding event.

The panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales. Specifically, shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may have played a role (Southall et al., 2013). The report also notes that prior use of a similar system in the general area may have sensitized the animals and also concluded that, for odontocete cetaceans that hear well in higher frequency ranges where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts. It is, however, important to note that the relatively lower output frequency, higher output power, and complex nature of the system implicated in this event, in context of the other factors noted here, likely

produced a fairly unusual set of circumstances that indicate that such events would likely remain rare and are not necessarily relevant to use of lower-power, higher-frequency systems more commonly used for scientific applications. The risk of similar events recurring may be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported.

Characteristics of the sound sources predominantly used by SWFSC further reduce the likelihood of effects to marine mammals, as well as the intensity of effect assuming that an animal perceives the signal. Intermittent exposures – as would occur due to the brief, transient signals produced by these sources – require a higher cumulative SEL to induce TTS than would continuous exposures of the same duration (i.e., intermittent exposure results in lower levels of TTS) (Mooney et al., 2009a; Finneran et al., 2010). In addition, intermittent exposures recover faster in comparison with continuous exposures of the same duration (Finneran et al., 2010). Although echosounder pulses are, in general, emitted rapidly, they are not dissimilar to odontocete echolocation click trains. Research indicates that marine mammals generally have extremely fine auditory temporal resolution and can detect each signal separately (e.g., Au et al., 1988; Dolphin et al., 1995; Supin and Popov, 1995; Mooney et al., 2009b), especially for species with echolocation capabilities. Therefore, it is likely that marine mammals would indeed perceive echosounder signals as being intermittent.

We conclude here that, on the basis of available information on hearing and potential auditory effects in marine mammals, high-frequency cetacean species would be the most likely to potentially incur temporary hearing loss from a vessel operating high-frequency sonar sources, and the potential for PTS to occur for any species is so unlikely as to be discountable. Even for high-frequency cetacean species, individuals would have to make a very close approach and also

remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS. Additionally, given that behavioral responses typically include the temporary avoidance that might be expected (see below), the potential for auditory effects considered physiological damage (injury) is considered extremely low in relation to realistic operations of these devices. Given the fact that fisheries research survey vessels are moving, the likelihood that animals may avoid the vessel to some extent based on either its physical presence or due to aversive sound (vessel or active acoustic sources), and the intermittent nature of many of these sources, the potential for TTS is probably low for high-frequency cetaceans and very low to zero for other species.

Based on the source operating characteristics, most of these sources may be detected by odontocete cetaceans (and particularly high-frequency specialists such as porpoises) but are unlikely to be audible to mysticetes (i.e., low-frequency cetaceans) and most pinnipeds. While low-frequency cetaceans and pinnipeds have been observed to respond behaviorally to low- and mid-frequency sounds (e.g., Frankel, 2005), there is little evidence of behavioral responses in these species to high-frequency sound exposure (e.g., Jacobs and Terhune, 2002; Kastelein *et al.*, 2006). If a marine mammal does perceive a signal from a SWFSC active acoustic source, it is likely that the response would be, at most, behavioral in nature. Behavioral reactions of free-ranging marine mammals to scientific sonars are likely to vary by species and circumstance. For example, Watkins *et al.* (1985) note that sperm whales did not appear to be disturbed by or even aware of signals from scientific sonars and pingers (36-60 kHz) despite being very close to the transducers, but Gerrodette and Pettis (2005) report that, when a 38-kHz echosounder and ADCP were on (1) the average size of detected schools of spotted dolphins and pilot whales was decreased; (2) perpendicular sighting distances increased for spotted and spinner dolphins; and

(3) sighting rates decreased for beaked whales. As described above, behavioral responses of marine mammals are extremely variable, depending on multiple exposure factors, with the most common type of observed response being behavioral avoidance of areas around aversive sound sources. Certain odontocete cetaceans (particularly harbor porpoises and beaked whales) are known to avoid high-frequency sound sources in both field and laboratory settings (e.g., Kastelein et al., 2000, 2005b, 2008a, b; Culik et al., 2001; Johnston, 2002; Olesiuk et al., 2002; Carretta et al., 2008). There is some additional, low probability for masking to occur for high-frequency specialists, but similar factors (directional beam pattern, transient signal, moving vessel) mean that the significance of any potential masking is probably inconsequential.

Potential Effects of Visual Disturbance

During AMLR surveys conducted during the southern hemisphere winter, pinnipeds are expected to be hauled out on ice and at times experience incidental close approaches by the survey vessel during the course of its fisheries research activities. SWFSC expects some of these animals will exhibit a behavioral response to the visual stimuli (e.g., including alert behavior, movement, vocalizing, or flushing). NMFS does not consider the lesser reactions (e.g., alert behavior) to constitute harassment. These events are expected to be infrequent and cause only a temporary disturbance on the order of minutes. Monitoring results from other activities involving the disturbance of pinnipeds and relevant studies of pinniped populations that experience more regular vessel disturbance indicate that individually significant or population level impacts are unlikely to occur.

In areas where disturbance of haul-outs due to periodic human activity (e.g., researchers approaching on foot, passage of small vessels, maintenance activity) occurs, monitoring results have generally indicated that pinnipeds typically move or flush from the haul-out in response to

human presence or visual disturbance, although some individuals typically remain hauled-out (e.g., SCWA, 2012). The nature of response is generally dependent on species. For example, California sea lions and northern elephant seals have been observed as less sensitive to stimulus than harbor seals during monitoring at numerous sites. Monitoring of pinniped disturbance as a result of abalone research in the Channel Islands showed that while harbor seals flushed at a rate of 69 percent, California sea lions flushed at a rate of only 21 percent. The rate for elephant seals declined to 0.1 percent (VanBlaricom, 2010).

Upon the occurrence of low-severity disturbance (i.e., the approach of a vessel or person as opposed to an explosion or sonic boom), pinnipeds typically exhibit a continuum of responses, beginning with alert movements (e.g., raising the head), which may then escalate to movement away from the stimulus and possible flushing into the water. Flushed pinnipeds typically re-occupy the haul-out within minutes to hours of the stimulus.

In a popular tourism area of the Pacific Northwest where human disturbances occurred frequently, past studies observed stable populations of seals over a twenty-year period (Calambokidis et al., 1991). Despite high levels of seasonal disturbance by tourists using both motorized and non-motorized vessels, Calambokidis et al. (1991) observed an increase in site use (pup rearing) and classified this area as one of the most important pupping sites for seals in the region. Another study observed an increase in seal vigilance when vessels passed the haul-out site, but then vigilance relaxed within ten minutes of the vessels' passing (Fox, 2008). If vessels passed frequently within a short time period (e.g., 24 hours), a reduction in the total number of seals present was also observed (Fox, 2008).

Level A harassment, serious injury, or mortality could likely only occur as a result of trampling in a stampede (a potentially dangerous occurrence in which large numbers of animals

succumb to mass panic and rush away from a stimulus) or abandonment of pups. However, AMLR surveys that have the potential to disturb pinnipeds on ice occur during austral winter and are unlikely to overlap in time with the periods when pups would be vulnerable to extended separation or trampling. While data on Antarctic pinniped phenology are limited, available information supports the intuitive conclusion that winter surveys would not overlap with pupping or lactation periods. The range of earliest to latest phocid pup observation over the course of five research voyages in east Antarctica from 1985-1999 was October 2, while the latest was December 25 (Southwell et al., 2003). Given the nature of potential disturbance – which would entail the gradual and highly visible approach of a large vessel – we would expect that pinnipeds would exhibit a gradual response escalation, and that stampeding would likely not be an issue.

Disturbance of pinnipeds caused by SWFSC survey activities – which are sparsely distributed in space and time – would be expected to last for only short periods of time, separated by significant amounts of time in which no disturbance occurred. Because such disturbance is sporadic, rather than chronic, and of low intensity, individual marine mammals are unlikely to incur any detrimental impacts to vital rates or ability to forage and, thus, loss of fitness. Correspondingly, even local populations, much less the overall stocks of animals, are extremely unlikely to accrue any significantly detrimental impacts.

Anticipated Effects on Marine Mammal Habitat

Effects to prey – In addition to direct, or operational, interactions between fishing gear and marine mammals, indirect (i.e., biological or ecological) interactions occur as well, in which marine mammals and fisheries both utilize the same resource, potentially resulting in competition that may be mutually disadvantageous (e.g., Northridge, 1984; Beddington et al., 1985; Wickens, 1995). Marine mammal prey varies by species, season, and location and, for

some, is not well documented. There is some overlap in prey of marine mammals in the CCE and the species sampled and removed during SWFSC research surveys, with primary species of concern being small, energy-rich, schooling species such as Pacific sardine, anchovies, and jack mackerel.

However, the total amount of these species taken in research surveys is very small relative to their overall biomass in the area (See Section 4.2.3 of the SWFSC EA for more information on fish catch during research surveys). For example, the average annual catch of Pacific sardines in the course of all SWFSC research surveys during 2007-11 was approximately 1.6 metric tons (mt). Research catch is therefore a very small fraction of the estimated biomass for Pacific sardines (157 million mt; Hill et al., 2011), and is negligible compared to the combined commercial harvest for sardines (145,861 mt) in the CCE (2010 data; Hill et al., 2011). The average annual catch of anchovies in the course of all SWFSC research surveys in the past five years is about 1.2 mt. Biomass estimates are not available for this species, but the overfishing level has been set at 139,000 mt and commercial harvests off the U.S. Pacific coast are about 2,093 mt per year (2010 data, Hill et al., 2011). For jack mackerel, average combined SWFSC research catch (0.4 mt) compares to an overfishing level of 126,000 mt and commercial harvests of about 309 mt (2010 data, Hill et al., 2011). Other species of fish and invertebrates that are used as prey by marine mammals are taken in research surveys as well but, as exemplified by these three predominant species, the proportions of research catch compared to biomass and commercial harvest is very small.

In addition to the small total biomass taken, some of the size classes of fish targeted in research surveys are very small (e.g., juvenile rockfish are typically only centimeters long) and these small size classes are not known to be prey of marine mammals in the CCE. Research

catches are also distributed over a wide area because of the random sampling design covering large sample areas. Fish removals by research are therefore highly localized and unlikely to affect the spatial concentrations and availability of prey for any marine mammal species. This is especially true for pinnipeds in the CCE, which are opportunistic predators that consume a wide assortment of fish and squid, and judging by their increasing populations throughout their range and expanding range into the Pacific Northwest (Caretta et al., 2014), food availability does not appear to be a limiting factor (Baraff and Loughlin, 2000; Scordino, 2010). The overall effect of research catches on marine mammals through competition for prey may therefore be considered insignificant for all species in the CCE.

SWFSC research catches in the ETP are currently limited to tiny amounts of plankton (about 20 kg total) and juvenile fish (about 1 kg total) collected over vast areas of the ocean. The effects on marine mammals are therefore insignificant for all species in the ETP. The addition of a few longline sets would likely take some species and size classes used as prey by marine mammals, but the effort would be so small and distributed over such a large area that it would not change this conclusion.

In the AMLR, SWFSC surveys are primarily focused on Antarctic krill, which are a key component of the food web for numerous marine mammals (including fur seals and baleen whales) as well as penguins and other birds. Acoustic data are used to measure abundance and distribution of krill but very small amounts of krill and zooplankton are also captured in small-mesh nets (e.g., IKMT) for biometric data. Krill abundance and distribution is driven by weather and oceanographic forces and varies tremendously over space (patchy distribution) and over time. Biomass estimates are only available in the few places where research occurs (South Shetland Islands and Elephant Island). Estimates of krill biomass in each of three monitored

areas have averaged between 0.5-2.5 million mt in the past few years (e.g., Van Cise, 2009). The amount of krill and other zooplankton collected during research is an insignificant fraction of overall biomass and would not affect the abundance or availability of prey for any marine mammals. The SWFSC also conducts periodic bottom trawl surveys in the South Orkney Islands area to monitor the recovery of several finfish that were overfished in the 1970s-80s. These surveys are only conducted every two or three years as funds and appropriate charter vessels become available. During one recent survey, a total of 7.7 mt of fish were collected from 65 species (Van Cise, 2009). This data has been used to estimate densities of the different species in the area, with the most common species caught having densities up to 7 mt/nm². It is not known how important these species or size classes taken during research are to marine mammals in the area. However, given the periodic nature of the surveys and the relatively small amount of fish removed from the system over a large area, it is unlikely to affect the distribution or availability of prey for any marine mammal species.

Acoustic habitat – Acoustic habitat is the soundscape – which encompasses all of the sound present in a particular location and time, as a whole – when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators), and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (e.g., produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic, or may be intentionally introduced to the marine environment for data acquisition purposes (as in the SWFSC's use of active acoustic sources). Anthropogenic noise varies widely in its frequency content, duration, and loudness and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please see also the previous discussion on masking under "Acoustic Effects"), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). For more detail on these concepts see, e.g., Barber et al., 2010; Pijanowski et al., 2011; Francis and Barber, 2013; Lillis et al., 2014.

Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber, 2013). As described above ("Acoustic Effects"), the signals emitted by SWFSC active acoustic sources are generally high frequency, of short duration, and transient. These factors mean that the signals will attenuate rapidly (not travel over great distances), may not be perceived or affect perception even when animals are in the vicinity, and would not be considered chronic in any given location. SWFSC use of these sources is widely dispersed in both space and time. In conjunction with the prior factors, this means that it is highly unlikely that SWFSC use of these sources would, on their own, have any appreciable effect on acoustic habitat. Sounds emitted by SWFSC vessels would be of lower frequency and continuous, but would also be widely dispersed in both space and time. SWFSC vessel traffic –

including both sound from the vessel itself and from the active acoustic sources – is of very low density compared to commercial shipping traffic or commercial fishing vessels and would therefore be expected to represent an insignificant incremental increase in the total amount of anthropogenic sound input to the marine environment.

Aside from bottom trawling in the AMLR – which is conducted only every two to three years in a relatively limited portion of the overall region, and therefore represents an insignificant impact – SWFSC activities would not be expected to have any impact on physical habitat in any specified geographical region. As described in the preceding, the potential for SWFSC research to affect the availability of prey to marine mammals or to meaningfully impact the quality of acoustic habitat is considered to be insignificant for all species, in all three specified geographical regions. Effects to habitat will not be discussed further in this document.

Estimated Take by Incidental Harassment, Serious Injury, or Mortality

Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment]. Serious injury means any injury that will likely result in mortality (50 CFR 216.3).

Take of marine mammals incidental to SWFSC research activities could occur as a result of (1) injury or mortality due to gear interaction (CCE and ETP only; Level A harassment, serious injury, or mortality); (2) behavioral disturbance resulting from the use of active acoustic

sources (Level B harassment only); or (3) behavioral disturbance of pinnipeds on ice resulting from close proximity of research vessels (AMLR only; Level B harassment only).

Estimated Take Due to Gear Interaction

Historical Interactions

In order to estimate the number of potential incidents of take that could occur by M/SI + Level A through gear interaction, we first consider SWFSC's record of past such incidents, and then consider in addition other species that may have similar vulnerabilities to SWFSC midwater trawl and pelagic longline gear as those species for which we have historical interaction records. Historical interactions with SWFSC research gear are described in Tables 10 and 11. Available records are for the years 2006 through present. All historical interactions have taken place in the California Current Ecosystem. Please see Figures 4.2-1 and 4.2-2 in the SWFSC EA for specific locations of these incidents.

Table 10. Historical interactions with trawl gear

Gear ¹	Survey	Date	Species	# killed	# released alive	Total
Midwater trawl	Coastal Pelagic Species (CPS)	4/24/2006	Northern fur seal (CA stock)	1	-	1
Midwater trawl	CPS	4/29/2007	Northern fur seal (CA stock)	1	-	1
Midwater trawl ²	Juvenile Rockfish	5/30/2007	Northern fur seal (eastern Pacific stock)	1	-	1
Midwater trawl	CPS	4/18/2008	California sea lion	1	-	1
Midwater trawl	CPS	4/21/2008	Pacific white-sided dolphin	1	-	1
Midwater trawl	CPS	4/26/2008	Pacific white-sided dolphin	2	-	2
Midwater trawl	CPS	4/27/2008	California sea lion	1	-	1
Midwater trawl	CPS	4/27/2008	Northern fur seal (eastern Pacific stock)	1	-	1
Midwater trawl ²	Juvenile Rockfish	6/15/2008	California sea lion	1	2	3
Midwater trawl	CPS	7/19/2008	Pacific white-sided dolphin	1	-	1
Midwater trawl	CPS	7/28/2008	California sea lion	1	-	1
Midwater trawl	CPS	7/31/2008	Northern fur seal (CA stock)	1	-	1
Midwater trawl	CPS	8/3/2008	Northern fur seal (CA stock)	1	-	1
Midwater trawl	CPS	8/9/2008	Pacific white-sided dolphin	11	-	11
Midwater trawl	CPS	8/9/2008	Northern right whale dolphin	6	-	6
Midwater trawl	CPS	8/14/2008	California sea lion	9	-	9
Midwater trawl	CPS	5/1/2009	Pacific white-sided dolphin	-	3	3
Midwater trawl ²	Juvenile Rockfish	5/25/2009	California sea lion	-	1	1
Midwater trawl	CPS	4/18/2010	Pacific white-sided dolphin	-	1	1
Midwater trawl	CPS	4/25/2010	Pacific white-sided dolphin	1	-	1
Midwater trawl ²	Juvenile Rockfish	9/10/2010	Pacific white-sided dolphin	1	-	1
Midwater trawl	CPS	4/3/2011	Pacific white-sided dolphin	1	-	1

Midwater trawl	Juvenile Salmon	9/9/2011	California sea lion	1	-	1
Midwater trawl	Juvenile Salmon	9/10/2011	Pacific white-sided dolphin	6	-	6
Midwater trawl	CPS	6/29/2012	Pacific white-sided dolphin	-	1	1
Midwater trawl	CPS	8/18/2012	Pacific white-sided dolphin	1	-	1
Midwater trawl	CPS	8/24/2012	Pacific white-sided dolphin	2	-	2
Midwater trawl	CPS	8/1/2013	Pacific white-sided dolphin	1	2	3
Midwater trawl	Juvenile Salmon	9/14/2013	Pacific white-sided dolphin	3	-	3
Midwater trawl ²	Juvenile Rockfish	6/1/2014	Pacific white-sided dolphin	1	-	1
Total individuals captured (total number of interactions given in parentheses)			Northern fur seal (6)	6	-	6
			California sea lion (7)	14	3	17
			Pacific white-sided dolphin (16)	32	7	39
			Northern right whale dolphin (1)	6	-	6

¹All incidents involved use of the NETS Nordic 264 midwater trawl, except as noted below.

²These incidents involved use of the modified-Cobb midwater trawl.

Table 11. Historical interactions with longline gear

Gear	Survey	Date	Species	# killed	# released alive	Total
Pelagic longline	Highly Migratory Species (HMS)	9/6/2008	California sea lion	-	1	1
Pelagic longline	HMS	9/15/2008	California sea lion	-	1	1
Pelagic longline	Thresher Shark	9/18/2009	California sea lion	-	1	1
Pelagic longline	HMS	7/27/2010	California sea lion	-	1	1
Pelagic longline	HMS	6/23/2012	California sea lion	-	1	1
Pelagic longline	HMS	7/10/2013	California sea lion	-	1	1
Pelagic longline	HMS	7/2/2014	California sea lion	-	1	1
Total				-	7	7

The SWFSC has no recorded interactions with any gear other than midwater trawl and pelagic longline. As noted previously in “Potential Effects of the Specified Activity on Marine Mammals,” we do not anticipate any future interactions in any other gears, including the bottom trawl gear periodically employed by the SWFSC in the AMLR. Although some historical interactions resulted in the animal(s) being released alive, no serious injury determinations (NMFS, 2012a; 2012b) were made, and it is possible that some of these animals later died. In order to use these historical interaction records in a precautionary manner as the basis for the take estimation process, and because we have no specific information to indicate whether any given future interaction might result in M/SI versus Level A harassment, we conservatively assume that all interactions equate to mortality.

During trawl surveys, SWFSC has recorded interactions with northern fur seals (California and eastern Pacific stocks; six total interactions with six individual animals); California sea lions (seven total interactions with seventeen animals); Pacific white-sided dolphins (sixteen interactions with 39 animals); and northern right whale dolphins (one interaction with six animals). No northern fur seal has been captured since 2008, and northern right whale dolphins have been involved in only one incident, also in 2008. Therefore, California sea lions and Pacific white-sided dolphins are the species most likely to interact with SWFSC trawl gear. Averages of 2.4 sea lions and 2.4 dolphins have been captured per interaction; however, these numbers are skewed by separate, single incidents in which nine sea lions and eleven dolphins were captured. The latter of these was the same trawl in which six northern right whale dolphins were captured and is the only incident in which more than one species was captured. Excluding these likely outliers leaves an average of 1.3 sea lions and 1.8 dolphins captured per event. For longline gear, only California sea lions have been captured. Each longline incident involved a single animal and all animals have been released alive; however, as for incidents involving trawl gear, no serious injury determinations were made.

In order to produce the most precautionary take estimates possible, we use here the most recent five years of data that includes 2008 (e.g., 2008-12). As previously noted, there were dramatically more of both interactions and animals captured (41 animals captured in fourteen interactions across both longline and trawl gear) in the year 2008 than in any other year (an average of 4.3 animals captured in 2.8 interactions in all other years). We believe a five-year time frame provides enough data to adequately capture year-to-year variation in take levels, while reflecting recent environmental conditions and survey protocols that may change over time.

California Current Ecosystem

In order to estimate the potential number of incidents of M/SI + Level A that could occur incidental to the SWFSC's use of midwater trawl and pelagic longline gear in the CCE over the five-year period from 2015-19, we first look at the four species described that have been taken historically and then evaluate the potential vulnerability of additional species to these gears. Table 12 shows the five-year annual average captures of these four species and the projected five-year totals for this proposed rule, for both trawl and longline gear. In order to produce precautionary estimates, we calculate the annual average for the designated five-year period (2008-12), round up to the nearest whole number, and assume that this number may be taken in each future year. This is precautionary in part because we include 2008 in the five-year average, which skews the data for all species captured in trawl gear (though not for longline). These estimates are based on the assumption that annual effort (e.g., total annual trawl tow time) over the proposed five-year authorization period will not exceed the annual effort during the period 2008-12.

Table 12. Annual average captures (2008-12) and projected five-year total for historically captured species

Gear	Species	2008	2009	2010	2011	2012	Maximum for any set ¹	Average per year	Projected 5-year total ²
Trawl	Pacific white-sided dolphin	15	3	3	7	4	11	6.4	35
	California sea lion	15	1	0	1	0	9	3.4	20
	Northern right whale dolphin	6	0	0	0	0	6	1.2	10
	Northern fur seal	3	0	0	0	0	1	0.6	5
Longline	California sea lion	2	1	1	0	1	1	1	5

¹The maximum number of individual animals captured in a single trawl tow or longline set, 2008-12.

²The estimated total is the product of the 2008-12 annual average rounded up to the nearest whole number and multiplied by the five-year timespan of the proposed rule.

As background to the process of determining which species not historically taken may have sufficient vulnerability to capture in SWFSC gear to justify inclusion in the take authorization request, we note that the SWFSC is NMFS' research arm in the southwest portion

of the West Coast Region and may be considered as a leading source of expert knowledge regarding marine mammals (e.g., behavior, abundance, density) in the areas where they operate. The species for which the take request was formulated were selected by the SWFSC, and we have concurred with these decisions.

In order to evaluate the potential vulnerability of additional species to midwater trawl and pelagic longline gear, we first consulted NMFS' List of Fisheries (LOF), which classifies U.S. commercial fisheries into one of three categories according to the level of incidental marine mammal M/SI that is known to occur on an annual basis over the most recent five-year period (generally) for which data has been analyzed: Category I, frequent incidental M/SI; Category II, occasional incidental M/SI; and Category III, remote likelihood of or no known incidental M/SI. We provide this information, as presented in the 2014 LOF (79 FR 14418; April 14, 2014), in Table 13 (note that Table 13 includes information for CCE and ETP species). In order to simplify information presented, and to encompass information related to other similar species from different locations, we group marine mammals by genus (where there is more than one member of the genus found in U.S. waters). Where there are documented incidents of M/SI incidental to relevant commercial fisheries, we note whether we believe those incidents provide sufficient basis upon which to infer vulnerability to capture in SWFSC research gear. More information is available on the Internet at: www.nmfs.noaa.gov/pr/interactions/lof/.

Table 13. U.S. commercial fisheries interactions for midwater trawl and pelagic longline for relevant species

Species ¹	Midwater trawl ²	Location/fishery ³	Vulnerability inferred? ⁴	Pelagic longline ²	Location/fishery ³	Vulnerability inferred? ⁴
Gray whale	N	n/a	n/a	N	n/a	n/a
Humpback whale	Y	AK BSAI pollock trawl (2)	N	Y	HI shallow-set longline (0.75)	N
<u>Balaenoptera</u> spp. ⁵	Y	AK GOA pollock trawl (0)	N	N	n/a	n/a
Sperm whale	N	n/a	n/a	Y	HI deep-set longline (3), ATL large pelagics longline (0)	N
<u>Kogia</u> spp.	N	n/a	n/a	Y	HI shallow-set longline (0)	Y
Cuvier's beaked	N	n/a	n/a	Y	American Samoa longline	N

whale					(0), ATL large pelagics longline (0)	
Baird's beaked whale	N	n/a	n/a	N	n/a	n/a
<u>Mesoplodon</u> spp.	N	n/a	n/a	Y	HI shallow-set longline (1) ⁷ , ATL large pelagics longline (0)	N
Rough-toothed dolphin	N	n/a	n/a	Y	American Samoa longline (10.9)	Y
Common bottlenose dolphin	N	n/a	n/a	Y	HI deep-set longline (9), HI shallow-set longline (7), ATL large pelagics longline (23.8)	Y
<u>Stenella</u> spp.	N	n/a	n/a	Y	HI deep-set longline (7), HI shallow-set longline (3), ATL large pelagics longline (16)	Y
<u>Delphinis</u> spp.	Y	MA midwater trawl (3.2), NE midwater trawl (0)	Y	Y	ATL large pelagics longline (8.5)	Y
Fraser's dolphin	N	n/a	n/a	N	n/a	n/a
<u>Lagenorhynchus</u> spp. ⁶	n/a	n/a	n/a	N	n/a	n/a
Northern right whale dolphin ⁶	n/a	n/a	n/a	N	n/a	n/a
Risso's dolphin	Y	MA midwater trawl (1)	Y	Y	HI deep-set longline (8), HI shallow-set longline (18), ATL large pelagics longline (49)	Y
Melon-headed whale	N	n/a	n/a	N	n/a	n/a
Pygmy killer whale	N	n/a	n/a	N	n/a	n/a
False killer whale	N	n/a	n/a	Y	HI deep-set longline (112) ⁸ , HI shallow-set longline (2.5) ⁸ , American Samoa longline (23.5)	Y
Killer whale	N	n/a	n/a	Y	ATL large pelagics longline (0)	N
<u>Globicephala</u> spp.	Y	MA midwater trawl (12), NE midwater trawl (16)	N	Y	HI deep-set longline (5.5) ⁸ , HI shallow-set longline (0.5) ⁸ , American Samoa longline (0), ATL large pelagics longline (598)	Y
Harbor porpoise	N	n/a	n/a	N	n/a	n/a
Dall's porpoise	Y	AK BSAI pollock trawl (1.2); AK GOA pollock trawl (0)	Y	N	n/a	n/a
Guadalupe fur seal	N	n/a	n/a	N	n/a	n/a
Northern fur seal ⁶	n/a	n/a	n/a	N	n/a	n/a
California sea lion ⁶	n/a	n/a	n/a	n/a	n/a	n/a
Steller sea lion	Y	AK BSAI pollock trawl (36.8); AK GOA pollock trawl (0)	Y	N	n/a	n/a
<u>Phoca</u> spp.	Y	AK BSAI pollock	Y	N	n/a	n/a

		trawl (1.2), NE midwater trawl (3.3)				
Northern elephant seal	Y	AK GOA pollock trawl (0)	Y	N	n/a	n/a

Category I fisheries using midwater trawl or pelagic longline gear (estimated # fishery participants): Hawaii (HI) deep-set longline (129); Atlantic Ocean, Caribbean, Gulf of Mexico (ATL) large pelagics longline (420)

Category II fisheries: HI shallow-set longline (20); Alaska Bering Sea, Aleutian Islands (AK BSAI) pollock (*Theragra chalcogramma*) trawl (95); American Samoa longline (24); HI shortline (11; no documented incidental M/SI); Mid-Atlantic (MA) midwater trawl (322); Northeast (NE) midwater trawl (1,103)

Category III fisheries: AK Gulf of Alaska (GOA) pollock trawl (62); California pelagic longline (1; no documented incidental M/SI); HI vertical longline (9; no documented incidental M/SI); AK food/bait herring trawl (4; no documented incidental M/SI)

¹Please refer to Table 3 for taxonomic reference.

²Indicates whether any member of the genus has documented incidental M/SI in a U.S. fishery using that gear in the most recent five-year timespan for which data is available.

³Values in parentheses represent estimates of M/SI for that fishery in the most recent five-year timespan for which data is available (2007-11 in most cases). An interaction may be prorated if it is documented as an injury but the severity of the injury is unknown (e.g., one entanglement may be estimated as 0.75 M/SI). Where there is less than one hundred percent observer coverage, documented M/SI is extrapolated to produce whole-fishery estimates. Associated CVs are not presented here; please refer to relevant SARs for more information. Some species have zero M/SI for 2007-11, but remain listed on that fishery's current list of marine mammal species/stocks injured/killed due to older interactions (e.g., one Cuvier's beaked whale capture was documented in the ATL large pelagics longline fishery in 2003).

⁴Where there are no documented incidents of M/SI incidental to relevant commercial fisheries, this is not applicable.

⁵One minke whale was captured in a midwater trawl and released alive by NMFS' Northeast Fisheries Science Center in 2009. It was later determined that this capture constituted a serious injury.

⁶This exercise is considered "not applicable" for those species historically captured in SWFSC gear. Historical record, rather than analogy, is considered the best information upon which to base a take estimate.

⁷One additional unidentified beaked whale was incidentally captured in this fishery during 2007-11.

⁸These include documented interactions with unidentified "blackfish" (i.e., pilot whales or false killer whales) and are prorated to species based on distance from shore.

Information related to incidental M/SI in relevant commercial fisheries is not, however, the sole determinant of whether it may be appropriate to authorize M/SI + Level A incidental to SWFSC survey operations. A number of factors (e.g., species-specific knowledge regarding animal behavior, overall abundance in the geographic region, density relative to SWFSC survey effort, feeding ecology, propensity to travel in groups commonly associated with other species historically taken) were taken into account by the SWFSC to determine whether a species may have a similar vulnerability to certain types of gear as historically taken species. In some cases,

we have determined that species without documented M/SI may nevertheless be vulnerable to capture in SWFSC research gear. Similarly, we have determined that some species groups with documented M/SI are not likely to be vulnerable to capture in SWFSC gear. In these instances, we provide further explanation below. Those species with no records of historical interaction with SWFSC research gear and no documented M/SI in relevant commercial fisheries, and for which the SWFSC has not requested the authorization of incidental take, are not considered further in this section. The SWFSC believes generally that any sex or age class of those species for which take authorization is requested could be captured.

In order to estimate a number of individuals that could potentially be captured in SWFSC research gear for those species not historically captured, we first determine which species may have vulnerability to capture in a given gear. Of those species, we then determine which may have a similar propensity to capture in a given gear as a historically captured species and which likely do not. For the former, we assume that, given similar propensity, it is possible that a worst-case scenario of take in a single trawl tow or longline set could occur while at the same time contending that, absent significant range shifts or changes in habitat usage, capture of a species not historically captured would likely be a very rare event. The former assumption also accounts for the likelihood that, for species that often travel in groups, an incident involving capture of that species is likely to involve more than one individual.

For example, we believe that the Risso's dolphin is potentially vulnerable to capture in midwater trawl gear and may have similar propensity to capture in that gear as does the Pacific white-sided dolphin. Because the greatest number of Pacific white-sided dolphins captured in any one trawl tow was eleven individuals (see Table 12), we assume that eleven Risso's dolphins could also be captured in a single incident. However, in recognition of the fact that any incident

involving the capture of Risso's dolphins would likely be a rare event, we propose a total take authorization over the five-year period of the number that may result from a single, worst-case incident (eleven dolphins). While we do not necessarily believe that eleven Risso's dolphins would be captured in a single incident – and that more capture incidents involving fewer individuals could occur, as opposed to a single, worst-case incident – we believe that this is a reasonable approach to estimating potential incidents of M/SI + Level A while balancing what could happen in a worst-case scenario with the potential likelihood that no incidents of capture would actually occur. The historical capture of northern right whale dolphins in 2008 provides an instructive example of a situation where a worst-case scenario (six dolphins captured in a single trawl tow) did occur, but overall capture of this species was very rare (no other capture incidents before or since).

Separately, for those species that we believe may have a vulnerability to capture in given gear but that we do not believe may have a similar propensity to capture in that gear as a historically captured species, we assume that capture would be a rare event that could involve multiple individuals captured in a single incident or one or two individuals captured in one or two incidents. For example, from the LOF we infer vulnerability to capture in trawl gear for the Dall's porpoise but do not believe that this species has a similar propensity for interaction in trawl gear as any historically captured species. Therefore, we assume that capture would represent a rare event that could occur in any year of the five-year period of proposed authorization and may involve one or more individuals. For these species we propose to authorize a total taking by M/SI + Level A of five individuals over the five-year timespan. These examples are provided to illustrate the process while more detail specific to gear types is given below.

Midwater trawl – From the 2014 LOF, we infer vulnerability to midwater trawl gear in the CCE for the Risso’s dolphin, short- and long-beaked common dolphins, Dall’s porpoise, Steller sea lion, harbor seal, and northern elephant seal. In addition, we consider some of these species to have a similar propensity for interaction with trawl gear as that demonstrated by the Pacific white-sided dolphin (Risso’s dolphin, short- and long-beaked common dolphins) and some of these to have similar propensity for interaction with trawl gear as that demonstrated by the California sea lion (Steller sea lion and harbor seal).

For some species, we believe that there is a reasonable likelihood of incidental take although there are no records of incidental M/SI in relevant commercial fisheries. The proposed take authorization for these species was determined to be appropriate based on analogy to other similar species that have been taken either in SWFSC operations or in analogous commercial fishery operations. Among species with no records of incidental M/SI in the LOF, we believe that the striped dolphin and bottlenose dolphin have a similar propensity for interaction with trawl gear as that demonstrated by the Pacific white-sided dolphin and that the harbor porpoise likely has vulnerability similar to that demonstrated by the Dall’s porpoise. Note also that, while the current LOF has no documented incidents of M/SI for these species incidental to midwater trawl fisheries, all have been taken incidentally in fisheries using bottom trawl gear.

It is also possible that a captured animal may not be able to be identified to species with certainty. Certain pinnipeds and small cetaceans are difficult to differentiate at sea, especially in low-light situations or when a quick release is necessary. For example, a captured delphinid that is struggling in the net may escape or be freed before positive identification is made. Therefore, the SWFSC has requested the authorization of incidental M/SI + Level A for one unidentified

pinniped and one unidentified small cetacean over the course of the five-year period of proposed authorization.

Pelagic longline – The process is the same as is described above for midwater trawl gear. From the 2014 LOF, we infer vulnerability to pelagic longline gear in the CCE for the Risso’s dolphin, bottlenose dolphin, striped dolphin, pygmy and dwarf sperm whale (i.e., Kogia spp.), short- and long-beaked common dolphins, and short-finned pilot whale. Despite an absence of records of incidental M/SI in the LOF for Steller sea lions, we also believe that this species is vulnerable to capture in pelagic longlines. We note here that, while the current LOF has no documented incidents of M/SI for Steller sea lions incidental to pelagic longline fisheries, the species has been taken in fisheries using bottom longline gear. We do not believe that any of these species have a similar propensity for interaction with pelagic longline gear as that demonstrated by the California sea lion, which is often present at high densities in the areas where SWFSC longline research is conducted. We also propose to authorize incidental M/SI + Level A for one unidentified pinniped over the course of the five-year period of proposed authorization.

Table 14. Total estimated M/SI + Level A due to gear interaction in the CCE, 2015-19

Species	Estimated 5-year total, midwater trawl ¹	Estimated 5-year total, pelagic longline ¹	Total, trawl + longline
<u>Kogia</u> spp. ²	-	1	1
Bottlenose dolphin (all stocks) ³	-	1	1
Bottlenose dolphin (CA/OR/WA offshore) ⁴	8	-	8
Bottlenose dolphin (CA coastal) ⁴	3	-	3
Striped dolphin	11	1	12
Short-beaked common dolphin	11	1	12
Long-beaked common dolphin	11	1	12
Pacific white-sided dolphin	35	-	35
Northern right whale dolphin	10	-	10
Risso’s dolphin	11	1	12
Short-finned pilot whale	-	1	1
Harbor porpoise ⁴	5	-	5
Dall’s porpoise	5	-	5
Northern fur seal ⁵	5	-	5
California sea lion	20	5	25
Steller sea lion	9	1	10

Harbor seal ⁴	9	-	9
Northern elephant seal	5	-	5
Unidentified pinniped	1	1	2
Unidentified cetacean	1	-	1

¹Please see Table 12 and preceding text for derivation of take estimates.

²We expect that only one Kogia spp. may be taken over the five-year timespan and that it could be either a pygmy or dwarf sperm whale.

³As a species believed to have similar propensity for capture in trawl gear as that demonstrated by the Pacific white-sided dolphin, we assume that eleven bottlenose dolphins could be captured over the five-year timespan. Total potential take of bottlenose dolphins in trawl gear has been apportioned by stock according to typical occurrence of that stock relative to SWFSC survey locations. We assume that a maximum of one total take of a bottlenose dolphin from either stock may occur in longline gear.

⁴Incidental take may be of animals from any stock, excluding Washington inland waters stocks.

⁵Incidental take may be of animals from either the eastern Pacific or California stocks.

For large whales, beaked whales, and killer whales, observed M/SI is extremely rare for trawl gear and, for most of these species, only slightly more common in longline gear. Although large whale species could become captured or entangled in SWFSC gear, the probability of interaction is extremely low considering the lower level of effort relative to that of commercial fisheries. For example, there were estimated to be three total incidents of sperm whale M/SI in the Hawaii deep-set longline fishery from 2007-11. This fishery has 129 participants, and the fishery as a whole exerts substantially greater effort in a given year than does the SWFSC. In a very rough estimate, we can say that these three estimated incidents between 2007-11 represent an insignificant per-participant interaction rate of 0.005 per year, despite the greater effort. Similarly, there were zero documented interactions from 2007-11 in the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery, despite a reported fishing effort of 8,044 sets and 5,955,800 hooks in 2011 alone (Garrison and Stokes, 2012). With an average soak time of ten to fourteen hours, this represents an approximate minimum of almost sixty million hook hours. For reference, an approximate maximum estimate of SWFSC effort is 135,000 hook hours per year. Other large whales, beaked whales and killer whales have similarly low rates of interaction with commercial fisheries, despite the significantly greater effort. In addition, large

whales, beaked whales, and killer whales generally have, with few exceptions, very low densities in the CCE relative to other species (see Table 19). We believe it extremely unlikely that any large whale, beaked whale, or killer whale would be captured or entangled in SWFSC research gear. Finally, although pilot whales have demonstrated vulnerability to midwater trawl gear in Atlantic fisheries, we do not infer vulnerability to capture in SWFSC trawl gear in the CCE because of the very low density of short-finned pilot whales (Table 19).

Eastern Tropical Pacific

The SWFSC does not currently conduct longline surveys in the ETP, but proposes to over the five-year period of this proposed rulemaking. The take estimates presented here reflect that likelihood. Assuming that longline surveys will be conducted in the ETP, the SWFSC anticipates that it will deploy an equal number (or less) of longline sets in the ETP relative to the number of sets currently being deployed in the CCE. The process described above for the CCE was used in determining vulnerability and appropriate take estimates for species in the ETP. We assume that a similar level of interaction with pelagic longline gear as that demonstrated by the California sea lion in the CCE could occur in the ETP, and also assume that the South American sea lion may have similar propensity for interaction with longline gear as that demonstrated by the California sea lion.

For all other species listed in Table 15, we infer vulnerability to pelagic longline gear in the ETP from the 2014 LOF (see Table 13), and assume that capture would likely be a rare event occurring at most once over the five-year period proposed for this rulemaking. We also propose to authorize incidental M/SI + Level A for one unidentified pinniped over the course of the five-year period of proposed authorization.

Those species with no records of historical interaction with SWFSC research gear and no documented M/SI in relevant commercial fisheries, and for which the SWFSC has not requested the authorization of incidental take, are not considered further in this section. Our rationale for excluding large whales, beaked whales, and killer whales from the species for which take is proposed to be authorized is the same as described previously for the CCE. As for the CCE, these species generally are estimated to have very low densities relative to other species (see Table 22). Finally, although *Stenella* spp. have demonstrated a general vulnerability to pelagic longline gear in U.S. commercial fisheries (see Table 13), there is no documented M/SI for spinner dolphins specifically. All *Stenella* spp. present in the ETP are also present in Hawaiian waters and, while Hawaii longline fisheries have documented interactions with striped dolphins and pantropical spotted dolphins, there are none for spinner dolphins. Therefore, we do not infer vulnerability to capture in SWFSC pelagic longline gear in the ETP for spinner dolphins.

Table 15. Total estimated M/SI + Level A due to gear interaction in the ETP, 2015-19

Species	Estimated 5-year total, pelagic longline ¹
Dwarf sperm whale	1
Rough-toothed dolphin	1
Bottlenose dolphin	1
Striped dolphin	1
Pantropical spotted dolphin ²	1
Short-beaked common dolphin ²	1
Long-beaked common dolphin	1
Risso's dolphin	1
False killer whale	1
Short-finned pilot whale	1
California sea lion	5
South American sea lion	5
Unidentified pinniped	1

¹Please see Tables 12 and 13 and preceding text for derivation of take estimates.

²Incidental take may be of animals from any stock.

Estimated Take Due to Acoustic Harassment

As described previously (“Potential Effects of the Specified Activity on Marine Mammals”), we believe that SWFSC use of active acoustic sources has, at most, the potential to

cause Level B harassment of marine mammals. In order to attempt to quantify the potential for Level B harassment to occur, NMFS (including the SWFSC and acoustics experts from other parts of NMFS) developed an analytical framework considering characteristics of the active acoustic systems described previously under “Description of Active Acoustic Sound Sources,” their expected patterns of use in each of the three SWFSC operational areas, and characteristics of the marine mammal species that may interact with them. We believe that this quantitative assessment benefits from its simplicity and consistency with current NMFS acoustic guidance regarding Level B harassment but caution that, based on a number of deliberately precautionary assumptions, the resulting take estimates should be seen as a likely substantial overestimate of the potential for behavioral harassment to occur as a result of the operation of these systems. Additional details on the approach used and the assumptions made that result in conservative estimates are described below.

The assessment paradigm for active acoustic sources used in SWFSC fisheries research is relatively straightforward and has a number of key simplifying assumptions. NMFS’ current acoustic guidance requires in most cases that we assume Level B harassment occurs when a marine mammal receives an acoustic signal at or above a simple step-function threshold. For use of these active acoustic systems, the appropriate threshold is 160 dB re 1 μ Pa (rms). Estimating the number of exposures at the specified received level requires several determinations, each of which is described sequentially below:

- (1) A detailed characterization of the acoustic characteristics of the effective sound source or sources in operation;
- (2) The operational areas exposed to levels at or above those associated with Level B harassment when these sources are in operation;

- (3) A method for quantifying the resulting sound fields around these sources; and
- (4) An estimate of the average density for marine mammal species in each area of operation.

Quantifying the spatial and temporal dimension of the sound exposure footprint (or “swath width”) of the active acoustic devices in operation on moving vessels and their relationship to the average density of marine mammals enables a quantitative estimate of the number of individuals for which sound levels exceed the relevant threshold for each area. The number of potential incidents of Level B harassment is ultimately estimated as the product of the volume of water ensonified at 160 dB rms or higher and the volumetric density of animals determined from simple assumptions about their vertical stratification in the water column. Specifically, reasonable assumptions based on what is known about diving behavior across different marine mammal species were made to segregate those that predominately remain in the upper 200 m of the water column versus those that regularly dive deeper during foraging and transit. Methods for estimating each of these calculations are described in greater detail in the following sections, along with the simplifying assumptions made, and followed by the take estimates for each specified geographical region.

Sound source characteristics – An initial characterization of the general source parameters for the primary active acoustic sources operated by the SWFSC was conducted, enabling a full assessment of all sound sources used by the SWFSC and delineation of Category 1 and Category 2 sources, the latter of which were carried forward for analysis here (see Table 2). This auditing of the active acoustic sources also enabled a determination of the predominant sources that, when operated, would have sound footprints exceeding those from any other simultaneously used sources. These sources were effectively those used directly in acoustic

propagation modeling to estimate the zones within which the 160 dB rms received level would occur.

Many of these sources can be operated in different modes and with different output parameters. In modeling their potential impact areas, those features among those given previously in Table 2 (e.g., lowest operating frequency) that would lead to the most precautionary estimate of maximum received level ranges (i.e., largest ensonified area) were used. The effective beam patterns took into account the normal modes in which these sources are typically operated. While these signals are brief and intermittent, a conservative assumption was taken in ignoring the temporal pattern of transmitted pulses in calculating Level B harassment events. Operating characteristics of each of the predominant sound sources were used in the calculation of effective line-kilometers and area of exposure for each source in each survey.

Table 16. Effective exposure areas for predominant acoustic sources across two depth strata

Active acoustic system	Effective exposure area: Sea surface to 200 m depth (km ²)	Effective exposure area: Sea surface to depth at which 160-dB threshold is reached (km ²)
Simrad EK500 and EK60 narrow beam echosounders	0.013072	0.135404
Simrad ME70 multibeam echosounder	0.018184	0.018184
Simrad MS70 multibeam sonar ¹	0.007952	0.007952
Simrad SX90 narrow beam sonar ²	0.065275	0.1634
Teledyne RD Instruments ADCP, Ocean Surveyor	0.0086	0.0187

¹Effective exposure areas from 0-200 m depth were not separately calculated because MS70 operates in a side-looking mode. The estimated area ensonified to the maximum range of the 160-dB threshold was used for this source in determining the effective exposure area for both depth strata.

²Exposure area varies greatly depending on the tilt angle setting of the SX90. To approximate the varied usage this system might receive, the exposure area for each depth strata was averaged by assuming equal usage at tilt angles of 5, 20, 45, and 80 degrees.

Among Category 2 sources (Table 2), five predominant sources (Table 16) were identified as having the largest potential impact zones during operations, based on their relatively lower output frequency, higher output power, and their operational pattern of use. Estimated effective cross-sectional areas of exposure were estimated for each of the five predominant sources using a commercial software package (MATLAB) and key input parameters including

source-specific operational characteristics (i.e., frequency, beamwidth, source level, tilt angle, and horizontal and vertical resolution; see Table 2) and environmental characteristics (i.e., depth for attenuation coefficient, temperature, salinity, pH, and latitude). Where relevant, calculations were performed for different notional operational scenarios and the largest cross-sectional area used in estimating take. For example, the EK60 cross-sectional area was calculated for (a) a simple cone at 3 dB points; (b) a rectangle derived from strip width * depth; and (c) integration of the nominal beam pattern, which assumes side lobes of ensonification (and which is displayed in Figure 6.1 of SWFSC's application).

In determining the effective line-kilometers for each of these predominant sources, the operational patterns of use relative to one another were further applied to determine which source was the predominant one operating at any point in time for each survey. When multiple sound sources are used simultaneously, the one with the largest potential impact zone in each relevant depth strata is considered for use in estimating exposures. For example, when species (e.g., sperm whales) regularly dive deeper than 200 m, the largest potential impact zone was calculated for both depth strata and in some cases resulted in a different source being predominant in one depth stratum or the other. This enabled a more comprehensive way of accounting for maximum exposures for animals diving in a complex sound field resulting from simultaneous sources with different spatial profiles. This overall process effectively resulted in three sound sources (Table 16; SX90, EK60, and ME70) comprising the total effective line-kilometers, their relative proportions depending on the nature of each survey in each region.

Calculating effective line-kilometers – As described below, based on the operating parameters for each source type, an estimated volume of water ensonified at or above the 160 dB rms threshold was determined. In all cases where multiple sources are operated simultaneously,

the one with the largest estimated acoustic footprint was considered to be the effective source. This was calculated for each depth stratum (0-200 m and greater than 200 m), which in some cases resulted in different sources being predominant in each depth stratum for all line-kilometers when multiple sources were in operation; this was accounted for in estimating overall exposures for species that utilize both depth strata (deep divers). For each ecosystem area, the total number of line-kilometers that would be surveyed was determined, as was the relative percentage of surveyed linear kilometers associated with each source type. The total line-kilometers for each vessel in each region, the effective percentages associated with each of the resulting three predominant source types (SX90, EK60, and ME70), and the effective total line-kilometers of operation for each source type in each region are given below.

Calculating volume of water ensonified – The cross-sectional area of water ensonified at or above the 160 dB rms threshold was calculated using a simple model of sound propagation loss, which accounts for the loss of sound energy over increasing range. We used a spherical spreading model (where propagation loss = $20 * \log [\text{range}]$; such that there would be a 6-dB reduction in sound level for each doubling of distance from the source), a reasonable approximation over the relatively short ranges involved, and accounted for the frequency-dependent absorption coefficient (α at 15°C and 33 ppt) and beam pattern of these sound sources, which is generally highly directional. The lowest frequency was used for systems that are operated over a range of frequencies. The vertical extent of this area is calculated for two depth strata (0-200 m and surface to range at which the on-axis received level reaches 160 dB rms). These results, shown in Table 16, were applied differentially based on the typical vertical stratification of marine mammals (see Tables 6.9-6.11). A simple visualization of a two-dimensional slice of modeled sound propagation is shown in Figure 6.1 of SWFSC's application

to illustrate the predicted area ensonified to the 160-dB threshold by an EK60 operated at 18 kHz.

Following the determination of effective sound exposure area for transmissions considered in two dimensions, the next step was to determine the effective volume of water ensonified at or above 160 dB rms for the entirety of each survey in each region. For each of the three predominant sound sources, the volume of water ensonified is estimated as the athwartship cross-sectional area (in square kilometers) of sound at or above 160 dB rms (as illustrated in Figure 6.1 of SWFSC's application) multiplied by the total distance traveled by the ship. Where different sources operating simultaneously would be predominant in each different depth strata (e.g., ME70 and EK60 operating simultaneously may be predominant in the shallow stratum and deep stratum, respectively), the resulting cross-sectional area calculated took this into account. Specifically, for shallow-diving species this cross-sectional area was determined for whichever was predominant in the shallow stratum, whereas for deeper-diving species this area was calculated from the combined effects of the predominant source in the shallow stratum and the (sometimes different) source predominating in the deep stratum. This creates an effective total volume characterizing the area ensonified when each predominant source is operated and accounts for the fact that deeper-diving species may encounter a complex sound field in different portions of the water column.

Marine mammal densities – One of the primary limitations to traditional estimates of behavioral harassment from acoustic exposure is the assumption that animals are uniformly distributed in time and space across very large geographical areas, such as those being considered here. There is ample evidence that this is in fact not the case and marine species are highly heterogeneous in terms of their spatial distribution, largely as a result of species-typical

utilization of heterogeneous ecosystem features. Some more sophisticated modeling efforts have attempted to include species-typical behavioral patterns and diving parameters in movement models that more adequately assess the spatial and temporal aspects of distribution and thus exposure to sound (e.g., Navy, 2013). While simulated movement models were not used to mimic individual diving or aggregation parameters in the determination of animal density in this estimation, the vertical stratification of marine mammals based on known or reasonably assumed diving behavior was integrated into the density estimates used.

First, typical two-dimensional marine mammal density estimates (animals/km²) were obtained from various sources for each ecosystem area. These were estimated from marine mammal Stock Assessment Reports (Allen and Angliss, 2012; Carretta *et al.*, 2011, 2012) and other sources (Barlow and Forney, 2007; ManTech-SRS Technologies, 2007) for the CCE, from abundance estimates using ship-based surveys of marine mammals in the ETP (Gerrodette *et al.*, 2008), and from ship-based surveys in the Antarctic. There are a number of caveats associated with these estimates:

(1) They are often calculated using visual sighting data collected during one season rather than throughout the year. The time of year when data were collected and from which densities were estimated may not always overlap with the timing of SWFSC fisheries surveys (detailed previously in “Detailed Description of Activities”). ETP and CCE marine mammal densities are calculated from sightings collected from August through November. Antarctic densities were calculated from sightings collected from January through March.

(2) The densities used for purposes of estimating acoustic exposures do not take into account the patchy distributions of marine mammals in an ecosystem, at least on the moderate to fine scales over which they are known to occur. Instead, animals are considered evenly

distributed throughout the assessed area and seasonal movement patterns are not taken into account.

In addition, and to account for at least some coarse differences in marine mammal diving behavior and the effect this has on their likely exposure to these kinds of often highly directional sound sources, a volumetric density of marine mammals of each species was determined. This value is estimated as the abundance averaged over the two-dimensional geographic area of the surveys and the vertical range of typical habitat for the population. Habitat ranges were categorized in two generalized depth strata (0-200 m and 0 to greater than 200 m) based on gross differences between known generally surface-associated and typically deep-diving marine mammals (e.g., Reynolds and Rommel, 1999; Perrin et al., 2009). Animals in the shallow-diving stratum were assumed, on the basis on empirical measurements of diving with monitoring tags and reasonable assumptions of behavior based on other indicators, to spend a large majority of their lives (i.e., greater than 75 percent) at depths shallower than 200 m. Their volumetric density and thus exposure to sound is therefore limited by this depth boundary. In contrast, species in the deeper-diving stratum were assumed to regularly dive deeper than 200 m and spend significant time at these greater depths. Their volumetric density and thus potential exposure to sound at or above the 160 dB rms threshold is extended from the surface to the depth at which this received level condition occurs (i.e., corresponding to the 0 to greater than 200 m depth stratum).

The volumetric densities are estimates of the three-dimensional distribution of animals in their typical depth strata. For shallow-diving species the volumetric density is the area density divided by 0.2 km (i.e., 200 m). For deeper diving species, the volumetric density is the area density divided by a nominal value of 0.5 km (i.e., 500 m). The two-dimensional and resulting

three-dimensional (volumetric) densities for each species in each ecosystem area are shown below.

Using area of ensonification and volumetric density to estimate exposures – Estimates of potential incidents of Level B harassment (i.e., potential exposure to levels of sound at or exceeding the 160 dB rms threshold) are then calculated for each specified geographical region by using (1) the combined results from output characteristics of each source and identification of the predominant sources in terms of acoustic output; (2) their relative annual usage patterns for each operational area; (3) a source-specific determination made of the area of water associated with received sounds at either the extent of a depth boundary or the 160 dB rms received sound level; and (4) determination of a biologically-relevant volumetric density of marine mammal species in each area. Estimates of Level B harassment by acoustic sources are the product of the volume of water ensonified at 160 dB rms or higher for the predominant sound source for each portion of the total line-kilometers for which it is used and the volumetric density of animals for each species. These annual estimates are given below for each ecosystem area. For each specified geographical region, we provide the information described in this paragraph.

California Current Ecosystem – We first provide information related to relative annual usage patterns of predominant active acoustic sources in the CCE. For example, the R/V Bell M. Shimada, which is expected to travel 39,456 line-kilometers annually in the CCE, uses the ME70 during fifty percent of that distance and the EK60 during one hundred percent of that distance (Table 17). When the ME70 is on, it is the dominant source in the 0-200 m depth stratum (0.018 km² cross-sectional ensonified area versus 0.013 km² cross-sectional ensonified area for the EK60; Table 16); therefore, the ME70 is the dominant active acoustic source for fifty percent of the line-kilometers and the EK60 is the dominant active acoustic source for the other fifty

percent. However, in the deeper depth stratum, the EK60 is always the dominant source when compared with the ME70 (0.135 km² cross-sectional ensonified area versus 0.018 km² cross-sectional ensonified area for the ME70; Table 16); therefore, the EK60 is the dominant active acoustic source in the deeper depth stratum at all times for the Shimada.

Table 17. Annual linear survey kilometers for each vessel operating in the CCE and its predominant sources within two depth strata

Vessel	Line-kms/ vessel	Source	Overall % source usage ²	% time source dominant (0- 200 m)	Line-km/ dominant source (0-200 m)	% time source dominant (>200 m)	Line-km/ dominant source (>200 m)
<u>Lasker</u>	67,760	SX90	50%	50%	33,880	50%	33,880
		EK60	100%	50%	33,880	50%	33,880
<u>Shimada</u>	39,456	ME70	50%	50%	19,728	0%	0
		EK60	100%	50%	19,728	100%	39,456
Other	26,304	EK60	100%	100%	26,304	100%	26,304

Table 18 then shows that, for example, the EK60 is the dominant source for sixty percent of total annual survey line-kilometers in the CCE in the 0-200 m depth stratum and is the dominant source for 75 percent of total annual survey line-kilometers in the CCE in the deeper depth stratum.

Table 18. Effective total annual survey kilometers for which each source type is the predominant acoustic source within two depth strata

Source	Summed dominant line- kms/ source (0-200 m)	Dominant source % total line-kms (0-200 m)	Summed dominant line- kms/ source (>200 m)	Dominant source % total line- kms (>200 m)
SX90	33,880	25.4%	33,880	25.4%
EK60	79,912	59.9%	99,640	74.6%
ME70	19,728	14.8%	0	0%

Next, we provide volumetric densities for marine mammals in the CCE and total estimated takes by Level B harassment, by dominant source and total, for each species in the CCE (Table 19). We also provide a sample calculation.

We first determine the source-specific ensonified volume of water (i.e., the ensonified volume where we consider a specific source to be predominant and therefore have the potential to harass marine mammals) and then determine source- and species-specific exposure estimates for the shallow and deep (if applicable; Table 19) depth strata. First, we know the estimated

source-specific cross-sectional ensonified area within the shallow and deep strata (Table 16) and the number of annual line-kilometers when a given source would be predominant in each stratum (Table 18) and use these values to derive an estimated source-specific ensonified volume. In order to estimate the additional volume of ensonified water in the deep stratum, we first subtract the cross-sectional ensonified area of the shallow stratum (which is already accounted for) from that of the deep stratum. Source- and stratum-specific exposure estimates are the product of these ensonified volumes and the species-specific volumetric densities (Table 19).

To illustrate the process, we focus on the EK60 and the sperm whale.

$$(1) \quad \text{EK60 ensonified volume; 0-200 m: } 0.013072 \text{ km}^2 * 79,912 \text{ km} = 1,044.6 \text{ km}^3$$

$$(2) \quad \text{EK60 ensonified volume; >200 m: } (0.135404 \text{ km}^2 - 0.013072 \text{ km}^2) * 99,640 \text{ km} = 12,189.2 \text{ km}^3$$

$$(3) \quad \text{Estimated exposures to sound } \geq 160 \text{ dB rms; sperm whale; EK60: } (0.0034 \text{ sperm whales/km}^3 * 1,044.6 \text{ km}^3 = 3.6 \text{ [rounded to 4]}) + (0.0034 \text{ sperm whales/km}^3 * 12,189.2 \text{ km}^3 = 41.4 \text{ [rounded to 41]}) = 45 \text{ estimated sperm whale exposures to SPLs } \geq 160 \text{ dB rms resulting from use of the EK60.}$$

Table 19. Densities and estimated source-, stratum-, and species-specific annual estimates of Level B harassment in the CCE

Species	Shallow	Deep	Area density (animals/km ²) 1	Volumetric density (animals/km ³) 2	Estimated Level B harassment, 0-200 m			Estimated Level B harassment, >200 m		Total
					EK60	ME70	SX90	EK60	SX90	
Gray whale	X		0.01913 ³	0.09565	100	34	212	0	0	346
Humpback whale	X		0.00083	0.00415	4	1	9	0	0	14
Minke whale	X		0.00072	0.00360	4	1	8	0	0	13
Sei whale	X		0.00009	0.00045	0	0	1	0	0	1
Fin whale	X		0.00184	0.00920	10	3	20	0	0	33
Blue whale	X		0.00136	0.00680	7	2	15	0	0	24
Sperm whale		X	0.00170	0.00340	4	1	8	41	11	65
Kogia spp.		X	0.00109	0.00218	2	1	5	27	7	42
Cuvier's beaked whale		X	0.00382	0.00764	8	3	17	93	25	146
Baird's beaked whale		X	0.00088	0.00176	2	1	4	21	6	34
Mesoplodont		X	0.00103	0.00206	2	1	5	25	7	40

beaked whales										
Bottlenose dolphin	X		0.00178	0.00890	9	3	20	0	0	32
Striped dolphin	X		0.01667	0.08335	87	30	184	0	0	301
Long-beaked common dolphin	X		0.01924	0.09620	100	35	213	0	0	348
Short-beaked common dolphin	X		0.30935	1.54675	1,616	555	3,421	0	0	5,592
Pacific white-sided dolphin	X		0.02093	0.10465	109	38	231	0	0	378
Northern right whale dolphin	X		0.00975	0.04875	51	17	108	0	0	176
Risso's dolphin	X		0.01046	0.05230	55	19	116	0	0	188
Killer whale	X		0.00071	0.00355	4	1	8	0	0	13
Short-finned pilot whale		X	0.00031	0.00062	1	0	1	8	2	12
Harbor porpoise	X		0.03775 ⁴	0.18873	197	68	417	0	0	682
Dall's porpoise	X		0.07553	0.37765	395	135	835	0	0	1,365
Guadalupe fur seal	X		0.00741 ³	0.03705	39	13	82	0	0	134
Northern fur seal	X		0.65239 ³	1.68275	1,758	604	3,721	0	0	11,791
California sea lion	X		0.29675 ³	1.19000	1,243	427	2,632	0	0	5,363
Steller sea lion	X		0.06316 ³	0.29165	305	105	645	0	0	1,141
Harbor seal	X		0.05493 ³	0.25200	263	90	557	0	0	993
Northern elephant seal		X	0.12400 ³	0.24800	259	89	548	3,023	824	4,743

¹All density estimates from Barlow and Forney (2007) unless otherwise indicated.

²Volumetric density estimates derived by dividing area density estimates by 0.2 km (for shallow species) or 0.5 km (for deep species), corresponding with defined depth strata.

³Density estimates derived by SWFSC from SAR abundance estimates and notional study area of 1,000,000 km².

⁴ManTech-SRS Technologies (2007) estimated a harbor porpoise density for coastal and inland waters of Washington, which is used as the best available proxy here. There are no known density estimates for harbor porpoises in SWFSC survey areas in the CCE.

Eastern Tropical Pacific – The process for estimating potential exposures of marine mammals in the ETP to sound from SWFSC active acoustic sources at or above the 160-dB rms threshold follows that described above. Please refer to that description; here, we provide the same information as for the CCE in tabular form.

Table 20. Annual linear survey kilometers for each vessel operating in the ETP and its predominant sources within two depth strata

Vessel	Line-kms/ vessel	Source	Overall % source usage ²	% time source dominant (0- 200 m)	Line-km/ dominant source (0-200 m)	% time source dominant (>200 m)	Line-km/ dominant source (>200 m)
<u>Lasker</u>	37,710	SX90	25%	25%	9,428	25%	9,428
		EK60	100%	75%	28,283	75%	28,283
<u>Shimada</u>	37,710	ME70	25%	25%	9,428	0%	0
		EK60	100%	75%	28,283	100%	37,710
Other	18,985	EK60	100%	100%	18,985	100%	18,985

Table 21. Effective total annual survey kilometers for which each source type is the predominant acoustic source within two depth strata

Source	Summed dominant line-kms/ source (0-200 m)	Dominant source % total line-kms (0-200 m)	Summed dominant line-kms/ source (>200 m)	Dominant source % total line-kms (>200 m)
SX90	9,428	10%	9,428	10%
EK60	75,550	80%	84,978	90%
ME70	9,428	10%	0	0%

Table 22. Densities and estimated source-, stratum-, and species-specific annual estimates of Level B harassment in the ETP

Species	Shallow	Deep	Area density (animals/km ²) ₁	Volumetric density (animals/km ³) ₂	Estimated Level B harassment, 0-200 m			Estimated Level B harassment, >200 m		Total
					EK60	ME70	SX90	EK60	SX90	
Humpback whale	X		0.00013	0.00067	1	0	0	0	0	1
Minke whale	X		0.00001 ³	0.00003	0	0	0	0	0	0
Bryde's whale	X		0.00049	0.00244	2	0	2	0	0	4
Sei whale	X		0.00000	0.00000	0	0	0	0	0	0
Fin whale	X		0.00003	0.00015	0	0	0	0	0	0
Blue whale	X		0.00019 ³	0.00097	1	0	1	0	0	2
Sperm whale		X	0.00019 ³	0.00039	0	0	0	4	0	4
Dwarf sperm whale		X	0.00053 ³	0.00105	1	0	1	11	1	14
Cuvier's beaked whale		X	0.00094 ³	0.00187	2	0	1	19	2	24
Longman's beaked whale		X	0.00004 ⁴	0.00007	0	0	0	1	0	1
Mesoplodont beaked whales		X	0.00119 ³	0.00237	2	0	1	25	2	30
Rough-toothed dolphin	X		0.00504	0.02521	25	4	16	0	0	45
Bottlenose dolphin	X		0.01573	0.07864	78	13	48	0	0	139
Striped dolphin	X		0.04516	0.22582	223	39	139	0	0	401
Pantropical spotted dolphin	X		0.12263 ⁵	0.61315	606	105	377	0	0	1,088
Spinner dolphin	X		0.04978 ⁶	0.24889	246	43	153	0	0	442
Long-beaked common dolphin	X		0.01945	0.09725	96	17	60	0	0	173
Short-beaked common dolphin	X		0.14645 ⁷	0.73227	723	126	451	0	0	1,300
Fraser's dolphin	X		0.01355 ³	0.06774	67	12	42	0	0	121
Dusky dolphin	X		0.00210	0.01050	10	2	6	0	0	18
Risso's dolphin	X		0.00517	0.02587	26	4	16	0	0	46
Melon-headed whale	X		0.00213 ³	0.01063	10	2	7	0	0	19
Pygmy killer whale	X		0.00183 ³	0.00913	9	2	6	0	0	17
False killer whale	X		0.00186 ³	0.00932	9	2	6	0	0	17
Killer whale	X		0.00040 ³	0.00199	2	0	1	0	0	3
Short-finned pilot whale		X	0.02760 ³	0.05520	55	9	34	574	51	723
Guadalupe fur seal	X		0.00741 ⁸	0.03705	37	6	23	0	0	66
California sea lion	X		0.16262 ⁹	0.81310	803	139	500	0	0	1,442

South American sea lion	X		0.16262 ⁹	0.81310	803	139	500	0	0	1,442
Northern elephant seal		X	0.12400 ⁸	0.24800	245	43	153	2,578	229	3,248

¹Please see footnotes to Table 4; densities calculated by SWFSC from sources listed. Note that values presented here are rounded to five digits, whereas the volumetric densities are calculated from the unrounded values. Densities derived from abundance estimates given in Gerrodette *et al.* (2008) calculated using given abundances divided by ETP area (sum of stratum areas given in first line of Table 1 in that publication). Densities calculated by SWFSC from abundance estimates reported in Wade and Gerrodette (1993) or, for those not reported in that publication, calculated from sighting data collected on board SWFSC cetacean and ecosystem assessment surveys in the ETP during 1998-2000, 2003, and 2006 using number of sightings (n), mean group size (s), total distance on effort (L) and effective strip width (w) (i.e., $D = n*s/2*w/L$).

²Volumetric density estimates derived by dividing area density estimates by 0.2 km (for shallow species) or 0.5 km (for deep species), corresponding with defined depth strata.

³The most recent abundance estimates are as reported in Table 4. SWFSC considered these species sufficiently rare in the core study area during 2006 survey effort to not warrant attempting to estimate abundance (Gerrodette *et al.*, 2008), but did estimate the unpublished ETP densities reported here.

⁴The most recent abundance estimate was reported in Barlow (2006) (see Table 4). SWFSC estimated the unpublished ETP density reported here from sighting data collected during SWFSC surveys in 1998-2000, 2003, and 2006.

⁵Given density is for northeastern offshore stock of pantropical spotted dolphins, and is calculated as stock abundance divided by the summed areas of Core, Core2, and N. Coastal strata (Gerrodette *et al.*, 2008). This is the largest density value for the three stocks of spotted dolphin in the ETP and is conservatively used here to calculate potential Level B takes of spotted dolphin in the ETP.

⁶Given density is for the eastern stock of spinner dolphins. This is the largest density value for the three stocks of spinner dolphin in the ETP and is conservatively used here to calculate potential Level B takes of spinner dolphin in the ETP. There is no estimate of abundance for the Central American stock of spinner dolphins.

⁷Abundance estimate from which density estimate is derived includes parts of northern and southern stocks and all of the central stock (Gerrodette *et al.*, 2008). There are no stock-specific abundance estimates.

⁸No abundance information exists for Guadalupe fur seals or northern elephant seals in the ETP. Therefore, we use density estimates from the CCE (Table 19) as a reasonable proxy.

⁹There are no available density estimates for California sea lions or South American sea lions in the ETP. The SWFSC reports that California sea lions are typically observed in the ETP only along the coast of Baja California, Mexico. Therefore, we estimate density for the California sea lion in the ETP using the upper bound of abundance for western Baja California (87,000; Lowry and Maravilla-Chavez, 2005) divided by the area of the N. Coastal stratum from Gerrodette *et al.* (2008). In the absence of other information, we use this value as a reasonable proxy for the South American sea lion.

Antarctic Marine Living Resources Ecosystem – The process for estimating potential exposures of marine mammals in the AMLR to sound from SWFSC active acoustic sources at or above the 160-dB rms threshold follows that described above. Please refer to that description; here, we provide the same information as for the CCE and ETP in tabular form.

Table 23. Annual linear survey kilometers for vessels operating in the AMLR and predominant source within two depth strata

Vessel	Line-kms/ vessel ¹	Source	Overall % source usage ²	% time source dominant (0- 200 m)	Line-km/ dominant source (0-200 m)	% time source dominant (>200 m)	Line-km/ dominant source (>200 m)
Other	20,846	EK60	100%	100%	20,846	100%	20,846

Table 24. Density (number/km surveyed) of marine mammals recorded during AMLR surveys 2006/07 to 2010/11

Species	2006/07	2007/08	2008/09	2009/10	2010/11
Southern right whale	0	0.00080	0	0.0003	0
Humpback whale	0.0571	0.03049	0.03605	0.0676	0.041
Antarctic minke whale	0.0033	0.00064	0.00182	0.0043	0.002
Fin whale	0.0323	0.04367	0.08391	0.0195	0.038
Southern bottlenose whale	0.0065	0	0.00061	0.0028	0.001
Hourglass dolphin	0	0	0.00151	0.0086	0.007
Killer whale	0	0	0.00151	0.0077	0.001
Long-finned pilot whale	0	0	0.00757	0	0
Antarctic fur seal	0.0140	0.08027	0.09996	0.0599	0.044
Southern elephant seal	0.0003	0.00016	0.00030	0.0006	0
Weddell seal	0.0007	0.00064	0	0	0
Crabeater seal	0.0003	0.00130	0	0.0003	0
Leopard seal	0	0	0.00030	0.0009	0

Source: Lipsky (2007), Van Cise (2008, 2009, 2011), Walsh (2014)

Table 24 displays year-by-year sightings data for SWFSC AMLR surveys from the most recent five seasons for which data is available (note that not all species expected to potentially be present in the AMLR have been observed during these surveys). Due to a general lack of abundance information in the Antarctic, and because these data are from the same area where the SWFSC proposes to continue survey operations, we believe that this is the best available information for use in estimating potential exposures to sound from SWFSC active acoustic sources. These surveys are generally conducted using standard line-transect theory by trained observers; however, the surveys are not conducted for the purpose of generating abundance estimates and effective strip width is not defined, nor are sightings data corrected for various biases (e.g., detection, perception) on an observer's ability to detect an animal. In order to produce precautionary estimates, we use the largest value recorded over the five seasons for use in calculating estimates of Level B harassment due to acoustic exposure in the AMLR (Table 25).

Table 25. Densities and estimated source-, stratum-, and species-specific annual estimates of Level B harassment in the AMLR

Species	Shallow	Deep	Area density (animals/km ²)	Volumetric density (animals/km ³) ¹	Estimated Level B harassment, 0-200 m	Estimated Level B harassment, >200 m	Total
					EK60	EK60	

Southern right whale	X		0.0008 ²	0.004	1	0	1
Humpback whale	X		0.0676 ²	0.338	92	0	92
Antarctic minke whale	X		0.0043 ²	0.0215	6	0	6
Fin whale	X		0.08391 ²	0.41955	114	0	114
Blue whale	X		0.00012 ³	0.0006	0	0	0
Sperm whale		X	0.00065 ³	0.0013	0	3	3
Arnoux' beaked whale		X	0.0065 ⁴	0.013	4	33	37
Southern bottlenose whale		X	0.0065 ²	0.013	4	33	37
Hourglass dolphin	X		0.0086 ²	0.043	12	0	12
Killer whale	X		0.0077 ²	0.0385	11	0	11
Long-finned pilot whale		X	0.00757 ²	0.01514	4	39	43
Spectacled porpoise	X		0.0086 ⁵	0.043	12	0	12
Antarctic fur seal	X		0.09996 ²	0.4998	136	0	136
Southern elephant seal		X	0.0006 ²	0.0012	0	3	3
Weddell seal	X		0.0007 ²	0.0035	1	0	1
Crabeater seal	X		0.0013 ²	0.0065	2	0	2
Leopard seal	X		0.0009 ²	0.0045	1	0	1

¹Volumetric density estimates derived by dividing area density estimates by 0.2 km (for shallow species) or 0.5 km (for deep species), corresponding with defined depth strata.

²Densities are the largest values recorded during AMLR surveys from 2006/07 through 2010/11. Please see Table 24.

³See footnotes to Table 5; densities calculated by SWFSC from sources listed.

⁴There is no available information for this species; therefore, we use the southern bottlenose whale as source of proxy information. However, this species is considered uncommon relative to the southern bottlenose whale (Taylor *et al.*, 2008); therefore, this is a conservative estimate.

⁵There is no available information for this species; therefore, we use the hourglass dolphin as source of proxy information. However, although considered to potentially have a circumpolar sub-Antarctic distribution, this species is seen only rarely at sea (Hammond *et al.*, 2008) and use of this value likely produces a conservative estimate.

Estimated Take Due to Physical Disturbance, Antarctic

Estimated take due to physical disturbance could potentially happen in the AMLR only as a result of the unintentional approach of SWFSC vessels to pinnipeds hauled out on ice, and would result in no greater than Level B harassment. During Antarctic ecosystem surveys conducted in the austral winter (i.e., June 1 through August 31), it is expected that shipboard activities may result in behavioral disturbance of some pinnipeds. It is likely that some pinnipeds on ice will move or flush from the haul-out into the water in response to the presence or sound of SWFSC survey vessels. Behavioral responses may be considered according to the scale shown in Table 26. We consider responses corresponding to Levels 2-3 to constitute Level B harassment.

Table 26. Seal response to disturbance

Level	Type of response	Definition
1	Alert	Head orientation in response to disturbance. This may include turning head towards the disturbance, craning head and neck while holding the body rigid in a u-shaped position, or changing from a lying to a sitting position.
2	Movement	Movements away from the source of disturbance, ranging from short withdrawals over short distances to hurried retreats many meters in length.
3	Flight	All retreats (flushes) to the water, another group of seals, or over the ice.

The SWFSC has estimated potential incidents of Level B harassment due to physical disturbance (Table 27) using the vessel distance traveled (20,846 km) during a typical AMLR survey, an effective strip width of 200 m (animals are assumed to react if they are less than 100 m from the vessel; see below), and the estimated population density for each species (Table 25). Although there is likely to be variation between individuals and species in reactions to a passing research vessel – that is, some animals assumed to react in this calculation will not react, and others assumed not to react because they are outside the effective strip width may in fact react – we believe that this approach is a reasonable effort towards accounting for this potential source of disturbance and have no information to indicate that the approach is biased either negatively or positively. SWFSC used an effective strip width of 200 m (i.e., 100 m on either side of a passing vessel) to be consistent with the regional marine mammal viewing guidelines that NMFS has established for Alaska, which restrict approaches to marine mammals to a distance of 100 m or greater in order to reduce the potential to cause inadvertent harm. Alaska is believed to have the most similar environment to the Antarctic of all regions for which NMFS has established viewing guidelines. Each estimate is the product of the species-specific density, annual line-kilometers, and the effective strip-width.

Table 27. Estimated annual Level B harassment of pinnipeds associated with AMLR vessel transects

Species	Density (animals/km ²)	Estimated Level B harassment
Antarctic fur seal	0.09996	417
Southern elephant seal	0.0006	3
Weddell seal	0.0007	3
Crabeater seal	0.0013	5

Leopard seal	0.0009	4
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Summary of Estimated Incidental Take

Here we provide summary tables detailing the total proposed incidental take authorization on an annual basis for each specified geographical region, as well as other information relevant to the negligible impact analyses.

Table 28. Summary information related to proposed annual take authorization in the CCE, 2015-19

Species ¹	Proposed total annual Level B harassment authorization	Percent of estimated population	Proposed total M/SI + Level A authorization, 2015-19	Estimated maximum annual M/SI + Level A ²	PBR ³	% PBR ⁴	Stock trend ⁵
Gray whale	346	1.8	0	0	n/a	-	↑
Humpback whale	14	0.7	0	0	n/a	-	↑
Minke whale	13	2.7	0	0	n/a	-	?
Sei whale	1	0.8	0	0	n/a	-	?
Fin whale	33	1.1	0	0	n/a	-	↑
Blue whale	24	1.5	0	0	n/a	-	?
Sperm whale	65	6.7	0	0	n/a	-	?
<i>Kogia</i> spp.	42	7.3	1	0.2	2.7	7.4	?
Cuvier's beaked whale	146	2.2	0	0	n/a	-	↓
Baird's beaked whale	34	4.0	0	0	n/a	-	?
Mesoplodont beaked whales	40	5.7	0	0	n/a	-	↓
Bottlenose dolphin (all stocks) ⁶	32	n/a	1	n/a	n/a	-	n/a
Bottlenose dolphin (CA/OR/WA offshore) ⁶		3.2 ⁹	8	2	5.5	36.4	?
Bottlenose dolphin (CA coastal) ⁶		9.9 ⁹	3	1	2.4	41.7	→
Striped dolphin	301	2.8	12	2.6	82	3.2	?
Long-beaked common dolphin	348	0.3	12	2.6	610	0.4	↑
Short-beaked common dolphin	5,592	1.4	12	2.6	3,440	0.1	?
Pacific white-sided dolphin	378	1.4	35	7.2	171	4.2	?
Northern right whale dolphin	176	2.1	10	2.2	48	4.6	?
Risso's dolphin	188	3.0	12	2.6	39	6.7	?
Killer whale ⁷	13	15.3	0	0	n/a	-	?
Short-finned pilot whale	12	1.6	1	0.2	4.6	4.3	?
Harbor porpoise ⁷	682	23.4	5	1.2	21	5.7	?
Dall's porpoise	1,365	3.3	5	1.2	257	0.5	?
Guadalupe fur seal	134	1.8	0	0	n/a	-	↑
Northern fur seal ⁷ (PI/EP)	11,555 ⁸	1.8	5	1.2	403	0.3	↑
Northern fur seal ⁷ (CA)	236 ⁸	1.8					

California sea lion	5,363	1.8	25	5.4	9,200	0.1	↑
Steller sea lion	1,141	1.8 ¹⁰	10	2.4	1,552	0.2	↑
Harbor seal ⁷	993	4.0	9	2	1,343	0.1	↑/→
Northern elephant seal	4,743	3.8	5	1.2	4,382	0.03	↑
Unidentified cetacean	n/a	n/a	1	n/a	n/a	-	n/a
Unidentified pinniped	n/a	n/a	2	n/a	n/a	-	n/a

Please see Tables 14 and 19 and preceding text for details.

¹For species with multiple stocks in CCE or for species groups (*Kogia* spp. and Mesoplodont beaked whales), indicated level of take could occur to individuals from any stock or species (not including Washington inland waters stocks of harbor porpoise and harbor seal).

²This column represents the total number of incidents of M/SI + Level A that could potentially accrue to the specified species or stock and is the number carried forward for evaluation in the negligible impact analysis (later in this document). To reach this total, we add one to the total for each pinniped or cetacean that may be captured in trawl gear and one to the total for each pinniped that may be captured in longline gear. This represents the potential that the take of an unidentified pinniped or small cetacean could accrue to any given stock captured in that gear. The proposed take authorization is formulated as a five-year total; the annual average is used only for purposes of negligible impact analysis. We recognize that portions of an animal may not be taken in a given year.

³See Table 3 and following discussion for more detail regarding PBR.

⁴Estimated maximum annual M/SI + Level A expressed as a percentage of PBR.

⁵See relevant SARs for more information regarding stock status and trends. Interannual increases may not be interpreted as evidence of a trend. For harbor seals, the CA stock is increasing, while the OR/WA coastal stock may have reached carrying capacity and appears stable. There are no evident trends for any harbor porpoise stock or for offshore killer whales.

⁶Total potential take of bottlenose dolphins in trawl gear has been apportioned by stock according to typical occurrence of that stock relative to SWFSC survey locations. We assume that only one total take of a bottlenose dolphin from either stock may occur in longline gear; therefore the estimated annual maximum numbers for bottlenose dolphin reflect the stock-specific trawl estimate plus one for the longline take plus one for the potential take of an unidentified cetacean.

⁷These species have multiple stocks in the CCE. Values for “percent of estimated population” and “PBR” (where relevant) calculated for the stock with the lowest population abundance and/or PBR (as appropriate). This approach assumes that all indicated takes would accrue to the stock in question, which is a very conservative assumption. Stocks in question are the southern resident killer whale, Morro Bay harbor porpoise, California northern fur seal, and OR/WA coastal harbor seal.

⁸Calculated on the basis of relative abundance; i.e., of 6,083 total estimated incidents of Level B harassment, we would expect on the basis of relative abundance in the study area that 98 percent would accrue to the Pribilof Islands/Eastern Pacific stock and two percent would accrue to the California stock.

⁹Calculated assuming that all 32 estimated annual incidents of Level B harassment occur to a given stock.

¹⁰A range is provided for Steller sea lion abundance. We have used the lower bound of the given range for calculation of this value.

Table 29. Proposed annual take authorization in the ETP, 2015-19

Species ¹	Proposed total annual Level B harassment authorization	Percent of estimated population ¹	Proposed total M/SI + Level A authorization, 2015-19	Estimated maximum annual M/SI + Level A ²	PBR ³	% PBR ⁴
Humpback whale	1	0.04	0	0	n/a	-
Minke whale	0	0	0	0	n/a	-
Bryde's whale	4	0.04	0	0	n/a	-

Sei whale	0	0	0	0	n/a	-
Fin whale	0	0	0	0	n/a	-
Blue whale	2	0.1	0	0	n/a	-
Sperm whale	4	0.1	0	0	n/a	-
Dwarf sperm whale	14	0.1	1	0.2	88 (0.2)	0.2
Cuvier's beaked whale	24	0.1	0	0	n/a	-
Longman's beaked whale	1	0.1	0	0	n/a	-
Mesoplodont beaked whales	30	0.1	0	0	n/a	-
Rough-toothed dolphin	45	0.04	1	0.2	897 (0.02)	0.02
Bottlenose dolphin	139	0.04	1	0.2	2,850 (0.01)	0.01
Striped dolphin	401	0.04	1	0.2	8,116 (0.002)	0.002
Pantropical spotted dolphin	1,088	0.4 ⁵	1	0.2	12,334 (0.002)	0.002
Spinner dolphin	442	0.1 ⁵	0	0	n/a	-
Long-beaked common dolphin	173	0.05	1	0.2	2,787 (0.01)	0.01
Short-beaked common dolphin	1,300	0.04	1	0.2	25,133 (0.001)	0.001
Fraser's dolphin	121	0.04	0	0	n/a	-
Dusky dolphin	18	0.04	0	0	n/a	-
Risso's dolphin	46	0.04	1	0.2	831 (0.02)	0.02
Melon-headed whale	19	0.04	0	0	n/a	-
Pygmy killer whale	17	0.04	0	0	n/a	-
False killer whale	17	0.04	1	0.2	244 (0.1)	0.1
Killer whale	3	0.04	0	0	n/a	-
Short-finned pilot whale	723	0.1	1	0.2	4,751 (0.004)	0.004
Guadalupe fur seal	66	0.9 ⁶	0	0	n/a	-
California sea lion	1,442	1.4	5	1.2	1,050 (0.1)	0.1
South American sea lion	1,442	1.0	5	1.2	1,500 (0.1)	0.1
Northern elephant seal	3,248	2.6 ⁶	0	0	n/a	-
Unidentified pinniped	n/a	n/a	1	n/a	n/a	-

Please see Tables 15 and 22 and preceding text for details.

¹For species with multiple stocks in ETP or for species groups (Mesoplodont beaked whales), indicated level of take could occur to individuals from any stock or species.

²This column represents the total number of incidents of M/SI + Level A that could potentially accrue to the specified species and is the number carried forward for evaluation in the negligible impact analysis (later in this document). To reach this total, we add one to the total for each pinniped that may be captured in longline gear. This represents the potential that the take of an

unidentified pinniped could accrue to any given species captured in that gear. The proposed take authorization is formulated as a five-year total; the annual average is used only for purposes of negligible impact analysis. We recognize that portions of an animal may not be taken in a given year.

³PBR values calculated by SWFSC; a pooled PBR was calculated for all stocks of the pantropical spotted dolphin (see Table 4).

⁴Estimated maximum annual M/SI + Level A expressed as a percentage of PBR.

⁵Evaluated against the stock with the lowest estimated abundance. For spinner dolphin, there is no abundance estimate for the Central American stock.

⁶There are no abundance estimates for these species in the ETP. We use the CCE abundance estimates as proxies in these calculations.

Table 30. Proposed annual take authorization in the AMLR, 2015-19

Species	Estimated annual Level B harassment (acoustic exposure)	Estimated annual Level B harassment (on-ice disturbance)	Proposed total annual Level B harassment authorization	Percent of estimated population ¹
Southern right whale	1	0	1	0.1
Humpback whale	92	0	92	1.0
Antarctic minke whale	6	0	6	0.03
Fin whale	114	0	114	2.4
Blue whale	0	0	0	0
Sperm whale	3	0	3	0.02
Arnoux' beaked whale ²	37	0	37	n/a
Southern bottlenose whale	37	0	37	0.1
Hourglass dolphin	12	0	12	0.01
Killer whale	11	0	11	0.04
Long-finned pilot whale	43	0	43	0.02
Spectacled porpoise ²	12	0	12	n/a
Antarctic fur seal	136	417	553	0.02
Southern elephant seal	3	3	6	0.001
Weddell seal	1	3	4	0.001 ³
Crabeater seal	2	5	7	0.0001 ³
Leopard seal	1	4	5	0.002 ³

Please see Tables 25 and 27 and preceding text for details.

¹See Table 5 for abundance information.

²There is no available abundance information for these species. See "Small Numbers Analyses" below for further discussion.

³A range is provided for these species' abundance. We have used the lower bound of the given range for calculation of these values.

Analyses and Preliminary Determinations

Here we provide separate negligible impact analyses and small numbers analyses for each of the three specified geographical regions for which we propose rulemaking.

Negligible Impact Analyses

NMFS has defined “negligible impact” in 50 CFR 216.103 as “...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.” A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be “taken” by mortality, serious injury, and Level A or Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (e.g., intensity, duration), the context of any such responses (e.g., critical reproductive time or location, migration), as well as effects on habitat. We also evaluate the number, intensity, and context of estimated takes by evaluating this information relative to population status. The impacts from other past and ongoing anthropogenic activities are incorporated into these analyses via their impacts on the environmental baseline (e.g., as reflected in the density/distribution and status of the species, population size and growth rate).

In 1988, Congress amended the MMPA, with provisions for the incidental take of marine mammals in commercial fishing operations. Congress directed NMFS to develop and recommend a new long-term regime to govern such incidental taking (see MMC, 1994). The need to set allowable take levels incidental to commercial fishing operations led NMFS to suggest a new and simpler conceptual means for assuring that incidental take does not cause any marine mammal species or stock to be reduced or to be maintained below the lower limit of its Optimum Sustainable Population (OSP) level. That concept (PBR) was incorporated in the 1994 amendments to the MMPA, wherein Congress enacted MMPA sections 117 and 118,

establishing a new regime governing the incidental taking of marine mammals in commercial fishing operations and stock assessments.

PBR, which is defined by the MMPA (16 U.S.C. 1362(20)) as “the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population,” is one tool that can be used to help evaluate the effects of M/SI on a marine mammal stock. OSP is defined by the MMPA (16 U.S.C. 1362(9)) as “the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element.” A primary goal of the MMPA is to ensure that each stock of marine mammal either does not have a level of human-caused M/SI that is likely to cause the stock to be reduced below its OSP level or, if the stock is depleted (i.e., below its OSP level), does not have a level of human-caused mortality and serious injury that is likely to delay restoration of the stock to OSP level by more than ten percent in comparison with recovery time in the absence of human-caused M/SI.

PBR appears within the MMPA only in section 117 (relating to periodic stock assessments) and in portions of section 118 describing requirements for take reduction plans for reducing marine mammal bycatch in commercial fisheries. PBR was not designed as an absolute threshold limiting human activities, but as a means to evaluate the relative impacts of those activities on marine mammal stocks. Specifically, assessing M/SI relative to a stock’s PBR may signal to NMFS the need to establish take reduction teams in commercial fisheries and may assist NMFS and existing take reduction teams in the identification of measures to reduce and/or minimize the taking of marine mammals by commercial fisheries to a level below a stock’s PBR. That is, where the total annual human-caused M/SI exceeds PBR, NMFS is not required to halt

fishing activities contributing to total M/SI but rather may prioritize working with a take reduction team to further mitigate the effects of fishery activities via additional bycatch reduction measures.

Since the introduction of PBR, NMFS has used the concept almost entirely within the context of implementing sections 117 and 118 and other commercial fisheries management-related provisions of the MMPA, including those within section 101(a)(5)(E) related to the taking of ESA-listed marine mammals incidental to commercial fisheries (64 FR 28800; May 27, 1999). The MMPA requires that PBR be estimated in stock assessment reports and that it be used in applications related to the management of take incidental to commercial fisheries (i.e., the take reduction planning process described in section 118 of the MMPA), but nothing in the MMPA requires the application of PBR outside the management of commercial fisheries interactions with marine mammals. Although NMFS has not historically applied PBR outside the context of sections 117 and 118, NMFS recognizes that as a quantitative tool, PBR may be useful in certain instances for evaluating the impacts of other human-caused activities on marine mammal stocks. In this analysis, we consider incidental M/SI relative to PBR for each affected stock, in addition to considering the interaction of those removals with incidental taking of that stock by harassment, within our evaluation of the likely impacts of the proposed activities on marine mammal stocks and in determining whether those impacts are likely to be negligible. Our use of PBR in this case does not make up the entirety of our impact assessment, but rather is being utilized as a known, quantitative metric for evaluating whether the proposed activities are likely to have a population-level effect on the affected marine mammal stocks. For the purposes of analyzing this specified activity, NMFS acknowledges that some of the fisheries research activities use similar gear and may have similar effects, but on a smaller scale, as marine

mammal take by commercial fisheries. The application of PBR for this specified activity of fisheries research allows NMFS to inform the take reduction team process which uses PBR to evaluate marine mammal bycatch in commercial fisheries due to the similarities of both activities.

California Current Ecosystem – Please refer to Table 28 for information relating to this analysis. As described in greater depth previously (see “Acoustic Effects”), we do not believe that SWFSC use of active acoustic sources has the likely potential to cause any effect exceeding Level B harassment of marine mammals. In addition, for the majority of species, the proposed annual take by Level B harassment is very low in relation to the population abundance estimate (less than ten percent) for each stock.

We have produced what we believe to be conservative estimates of potential incidents of Level B harassment. The procedure for producing these estimates, described in detail in “Estimated Take Due to Acoustic Harassment,” represents NMFS’ best effort towards balancing the need to quantify the potential for occurrence of Level B harassment due to production of underwater sound with a general lack of information related to the specific way that these acoustic signals, which are generally highly directional and transient, interact with the physical environment and to a meaningful understanding of marine mammal perception of these signals and occurrence in the areas where SWFSC operates. The sources considered here have moderate to high output frequencies (10 to 180 kHz), generally short ping durations, and are typically focused (highly directional) to serve their intended purpose of mapping specific objects, depths, or environmental features. In addition, some of these sources can be operated in different output modes (e.g., energy can be distributed among multiple output beams) that may lessen the

likelihood of perception by and potential impacts on marine mammals in comparison with the quantitative estimates that guide our proposed take authorization.

In particular, low-frequency hearing specialists (i.e., mysticetes) and certain pinnipeds (i.e., otariids) are less likely to perceive or, given perception, to react to these signals than the quantitative estimates indicate. These groups have reduced functional hearing at the higher frequencies produced by active acoustic sources considered here (e.g., primary operating frequencies of 40-180 kHz) and, based purely on their auditory capabilities, the potential impacts are likely much less (or non-existent) than we have calculated as these relevant factors are not taken into account.

However, for purposes of this analysis, we assume that the take levels proposed for authorization will occur. As described previously, there is some minimal potential for temporary effects to hearing for certain marine mammals (i.e., odontocete cetaceans), but most effects would likely be limited to temporary behavioral disturbance. Effects on individuals that are taken by Level B harassment will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring), reactions that are considered to be of low severity (e.g., Southall et al., 2007). There is the potential for behavioral reactions of greater severity, including displacement, but because of the directional nature of the sources considered here and because the source is itself moving, these outcomes are unlikely and would be of short duration if they did occur. Although there is no information on which to base any distinction between incidents of harassment and individuals harassed, the same factors, in conjunction with the fact that SWFSC survey effort is widely dispersed in space and time, indicate that repeated exposures of the same individuals would be very unlikely.

We now consider the level of taking by M/SI + Level A proposed for authorization. First, it is likely that required injury determinations will show some undetermined number of gear interactions to result in Level A harassment rather than serious injury and that, therefore, our authorized take numbers are overestimates with regard solely to M/SI. In addition, we note that these proposed take levels are likely precautionary overall when considering that: (1) estimates for historically taken species were developed assuming that the annual average number of takes from 2008-12, which is heavily influenced by inclusion of a year where dramatically more marine mammals were incidentally taken than any other year on record, would occur in each year from 2015-19; and that (2) the majority of species for which take authorization is proposed have never been taken in SWFSC surveys.

However, assuming that all of the takes proposed for authorization actually occur, we assess these quantitatively by comparing to the calculated PBR for each stock. Estimated M/SI for all stocks is significantly less than PBR (below ten percent, even when making the unlikely assumption that all takes for species with multiple stocks would accrue to the stock with the lowest PBR) with the exception of the two bottlenose dolphin stocks. The annual average take by M/SI + Level A for these stocks – which for each assumes that the single take of a bottlenose dolphin in longline gear that is proposed for authorization occurs for that stock, as well as that the single take of an unidentified cetacean proposed for authorization occurs – is, however, well below the PBR (takes representing 36 and 42 percent). We also note that, for the California coastal stock, the PBR is likely biased low because the population abundance estimate, which is based on photographic mark-recapture surveys, does not reflect that approximately 35 percent of dolphins encountered lack identifiable dorsal fin marks (Defran and Weller, 1999). If 35 percent of all animals lack distinguishing marks, then the true population size (and therefore PBR) would

be approximately 450-500 animals (i.e., approximately forty-fifty percent larger than the current estimate) (Carretta et al., 2014). The California coastal stock is believed to be stable, based on abundance estimates from 1987-89, 1996-98, and 2004-05 (Dudzik et al., 2006), and current annual human-caused M/SI is considered to be insignificant and approaching zero (Carretta et al., 2014). No population trends are known for the offshore stock. However, these proposed levels of take do not take into consideration the potential efficacy of the mitigation measures proposed by the SWFSC. Although potentially confounded by other unknown factors, incidental take of marine mammals in SWFSC survey gear (particularly trawl nets) has decreased significantly from the high in 2008 since the measures proposed here were implemented in 2009. We believe this demonstrates the likely potential for reduced takes of any species, including bottlenose dolphins, relative to these take estimates which are formulated based on the level of taking that occurred in 2008.

For certain species of greater concern, we also evaluate the proposed take authorization for Level B harassment in conjunction with that proposed for M/SI + Level A. For the bottlenose dolphin, if all acoustic takes occurred to a single stock, it would comprise 9.9 percent of the California coastal stock and only 3.2 percent of the offshore stock. However, it is unlikely that all of these takes would accrue to a single stock and the significance of this magnitude of Level B harassment is even lower. We do not consider the proposed level of acoustic take for bottlenose dolphin to represent a significant additional population stressor when considered in context with the proposed level of take by M/SI + Level A. Harbor porpoise are known to demonstrate increased sensitivity to acoustic signals in the frequency range produced by some SWFSC active acoustic sources (see discussion above under “Acoustic Effects”). The total annual taking by Level B harassment proposed for authorization for harbor porpoise would likely

be distributed across all five stocks of this species that occur in the CCE. Moreover, because the SWFSC does not regularly operate the surveys described above within the confines of Morro Bay, Monterey Bay, or San Francisco Bay, and because SWFSC survey effort is sparsely distributed in space and time, we would expect any incidents of take occurring to animals of those stocks to be transient events, largely occurring to individuals of those populations occurring outside those bays but within the general limit of harbor porpoise occurrence (i.e., the 200-m isobath). Finally, approximately 95 percent of annual SWFSC line-kilometers traveled using active acoustic sources (see Table 17) are beyond the 200-m isobaths. This was not taken into account in the calculation of acoustic take estimates; therefore, these estimates are likely substantial overestimates of the number of incidents of Level B harassment that may occur for harbor porpoise.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the planned mitigation measures, we preliminarily find that the total marine mammal take from SWFSC's fisheries research activities will have a negligible impact on the affected marine mammal species or stocks in the California Current Ecosystem. In summary, this finding of negligible impact is founded on the following factors: (1) the possibility of injury, serious injury, or mortality from the use of active acoustic devices may reasonably be considered discountable; (2) the anticipated incidents of Level B harassment from the use of active acoustic devices consist of, at worst, temporary and relatively minor modifications in behavior; (3) the predicted number of incidents of combined Level A harassment, serious injury, and mortality are at insignificant levels relative to all affected stocks but two; (4) the predicted number of incidents of both Level B harassment and potential M/SI likely represent overestimates; and (5) the

presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact. In addition, no M/SI is proposed for authorization for any species or stock that is listed under the ESA or considered depleted under the MMPA. In combination, we believe that these factors demonstrate that the specified activity will have only short-term effects on individuals (resulting from Level B harassment) and that the total level of taking will not impact rates of recruitment or survival sufficiently to result in population-level impacts.

Eastern Tropical Pacific – Please refer to Table 29 for information relating to this analysis. The entirety of the qualitative discussion provided above for the California Current Ecosystem is applicable to SWFSC use of active acoustic sources in the ETP, and is not repeated here. As for the CCE, we compare the maximum annual take estimate to the calculated PBR level. However, proposed take by M/SI + Level A is substantially less than one percent (in most cases, less than a tenth of a percent) of population abundance for all species for which such take is proposed to be authorized and, as for the CCE, these proposed levels of take are likely overestimates. We do propose to authorize one occurrence of M/SI over five years for the pantropical spotted dolphin; two of the three stocks of this species in the ETP are considered depleted under the MMPA. Therefore, although the maximum annual take estimate for this species is extremely low relative to the PBR level (0.002 percent), we provide additional discussion.

In the ETP, yellowfin tuna are known to associate with several species of dolphin, including spinner, spotted, and common dolphins. As the ETP tuna purse-seine fishery began in the late 1950s, incidental take of dolphins increased to very high levels and continued through the 1960s and into the 1970s (Perrin, 1969). Through a series of combined actions, including

passage of the MMPA in 1972, subsequent amendments, regulations, and mitigation measures, dolphin bycatch in the ETP has since decreased 99 percent in the international fishing fleet, and was eliminated by the U.S. fleet (Gerrodette and Forcada, 2005). However, the northeastern offshore and coastal stocks of spotted dolphin are believed to have declined roughly eighty and sixty percent, respectively, from pre-exploitation abundance estimates (Perrin, 2009). Although incidental take by the international fishing fleet is believed to have declined to the low hundreds of individuals annually (Perrin, 2009), the populations have not grown toward recovery as rapidly as expected (e.g., the population trend for the northeastern offshore stock is flat; Wade et al., 2007). Continued (non-lethal) chase and capture in the fishery may have an indirect effect on fecundity or survival, or there may have been a change in carrying capacity of the ecosystem for this species (Archer et al., 2004; Gerrodette and Forcada, 2005; Wade et al., 2007; Perrin, 2009). Nevertheless, the proposed authorized take of a single pantropical spotted dolphin over five years – which could occur to either the northeastern offshore or coastal stocks, or the non-depleted western and southern offshore stock – represents a negligible impact to any of these stocks, even when considered in context with incidental take in international commercial fisheries (the total taking, which is known only approximately would likely be around one percent of the total abundance). The taking proposed here represents an insignificant incremental increase over any incidental take occurring in commercial fisheries.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the planned mitigation measures, we preliminarily find that the total marine mammal take from SWFSC's fisheries research activities will have a negligible impact on the affected marine mammal species or stocks in the Eastern Tropical Pacific. In summary, this finding of negligible

impact is founded on the following factors: (1) the possibility of injury, serious injury, or mortality from the use of active acoustic devices may reasonably be considered discountable; (2) the anticipated incidents of Level B harassment from the use of active acoustic devices consist of, at worst, temporary and relatively minor modifications in behavior; (3) the predicted number of incidents of combined Level A harassment, serious injury, and mortality are at insignificant levels relative to all affected stocks; (4) the predicted number of incidents of both Level B harassment and potential M/SI likely represent overestimates; and (5) the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact. In addition, no M/SI is proposed for authorization for any species or stock that is listed under the ESA. In combination, we believe that these factors demonstrate that the specified activity will have only short-term effects on individuals (resulting from Level B harassment) and that the total level of taking will not impact rates of recruitment or survival sufficiently to result in population-level impacts.

Antarctic Marine Living Resources Ecosystem – Please refer to Table 30 for information relating to this analysis. No take by Level A harassment, serious injury, or mortality is proposed for authorization in the AMLR. The entirety of the qualitative discussion provided above for the California Current Ecosystem is applicable to SWFSC use of active acoustic sources in the AMLR, and is not repeated here. Given the limited spatio-temporal footprint of SWFSC survey activity in the Antarctic – survey activity only occurs within a limited area of Antarctic waters and only for a few months in any given year – we believe that the level of taking by Level B harassment proposed for authorization represents a negligible impact to these species.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the

planned mitigation measures, we preliminarily find that the total marine mammal take from SWFSC's fisheries research activities will have a negligible impact on the affected marine mammal species or stocks in the Antarctic Marine Living Resources Ecosystem. In summary, this finding of negligible impact is founded on the following factors: (1) the possibility of injury, serious injury, or mortality from the use of active acoustic devices may reasonably be considered discountable; (2) the anticipated incidents of Level B harassment from the use of active acoustic devices consist of, at worst, temporary and relatively minor modifications in behavior; (3) no incidental take by Level A harassment, serious injury, or mortality is proposed; (4) the predicted number of incidents of Level B harassment likely represent overestimates; and (5) the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact. In combination, we believe that these factors demonstrate that the specified activity will have only short-term effects on individuals. The specified activity is not expected to impact rates of recruitment or survival and will therefore not result in population-level impacts.

Small Numbers Analyses

California Current Ecosystem – Please see Table 28 for information relating to this small numbers analysis. The total amount of taking proposed for authorization is less than ten percent for all stocks, with the exception of certain species-wide totals when evaluated against the stock with the smallest abundance. The total taking for killer whales represents approximately fifteen percent of the southern resident stock; however, given the limited range of this stock relative to SWFSC survey operations, it is extremely unlikely that all takes would accrue to that stock. The total taking represents less than ten percent of the population abundance for other stocks of killer whale. The total species-wide taking by Level B harassment for harbor porpoise represents

approximately 23 percent of the Morro Bay stock of harbor porpoise, which has the smallest population abundance of five harbor porpoise stocks in the CCE. Although this value is within the bounds of takings that NMFS has considered to be small in the past, it is likely that the taking will be distributed in some fashion across the five stocks; and therefore, the amount of take occurring for any one stock would be much less than 23 percent.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed mitigation measures, we preliminarily find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks in the California Current Ecosystem.

Eastern Tropical Pacific – Please refer to Table 29 for information relating to this analysis. The total amount of taking proposed for authorization is less than three percent for all stocks.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed mitigation measures, we preliminarily find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks in the Eastern Tropical Pacific.

Antarctic Marine Living Resources Ecosystem – Please refer to Table 30 for information relating to this analysis. The total amount of taking proposed for authorization is less than three percent for all stocks.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the

proposed mitigation measures, we preliminarily find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks in the Antarctic Marine Living Resources Ecosystem.

Proposed Monitoring and Reporting

In order to issue an incidental take authorization for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth “requirements pertaining to the monitoring and reporting of such taking.” The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area.

Any monitoring requirement we prescribe should improve our understanding of one or more of the following:

- Occurrence of marine mammal species in action area (e.g., presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (e.g., source characterization, propagation, ambient noise); (2) affected species (e.g., life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (e.g., age, calving, or feeding areas).
- Individual responses to acute stressors, or impacts of chronic exposures (behavioral or physiological).
- How anticipated responses to stressors impact either: (1) long-term fitness and

survival of an individual; or (2) population, species, or stock.

- Effects on marine mammal habitat and resultant impacts to marine mammals.
- Mitigation and monitoring effectiveness.

SWFSC plans to make more systematic its training, operations, data collection, animal handling and sampling protocols, etc. in order to improve its ability to understand how mitigation measures influence interaction rates and ensure its research operations are conducted in an informed manner and consistent with lessons learned from those with experience operating these gears in close proximity to marine mammals. It is in this spirit that we propose the monitoring requirements described below.

Visual Monitoring

Marine mammal watches are a standard part of conducting fisheries research activities, and are implemented as described previously in “Proposed Mitigation.” Dedicated marine mammal visual monitoring occurs as described (1) for a minimum of thirty minutes prior to deployment of midwater trawl and pelagic longline gear; (2) throughout deployment and active fishing of all research gears; (3) for a minimum of thirty minutes prior to retrieval of pelagic longline gear; and (4) throughout retrieval of all research gear. This visual monitoring is performed by trained SWFSC personnel with no other responsibilities during the monitoring period. Observers record the species and estimated number of animals present and their behaviors, which may be valuable information towards an understanding of whether certain species may be attracted to vessels or certain survey gears. Separately, marine mammal watches are conducted by watch-standers (those navigating the vessel and other crew; these will typically not be SWFSC personnel) at all times when the vessel is being operated. The primary focus for this type of watch is to avoid striking marine mammals and to generally avoid navigational

hazards. These watch-standers typically have other duties associated with navigation and other vessel operations and are not required to record or report to the scientific party data on marine mammal sightings, except when gear is being deployed or retrieved.

In the Antarctic only, the SWFSC will monitor any potential disturbance of pinnipeds on ice, paying particular attention to the distance at which different species of pinniped are disturbed. Disturbance will be recorded according to the three-point scale, representing increasing seal response to disturbance, shown in Table 26.

Acoustic Monitoring

SWFSC will log passive acoustic data before and during the conduct of each trawl (either pelagic trawl in the CCE or bottom trawl in the AMLR). These data would not be used to decide whether to trawl but may be useful in comparing the level of vocalization present in the event of a marine mammal interaction for post hoc analyses of patterns that may indicate when marine mammal interactions are likely.

Marine Mammal Excluder Device

The SWFSC proposes to evaluate development of an MMED suitable for use in the modified-Cobb midwater trawl. Modified-Cobb trawl nets are considerably smaller than Nordic 264 trawl nets, are fished at slower speeds, and have a different shape and functionality than the Nordic 264. Due to the smaller size of the modified-Cobb net, this gear does not yet have a suitable marine mammal excluder device but research and design work are currently being performed to develop effective excluders that will not appreciably affect the catchability of the net and therefore maintain continuity of the fisheries research dataset.

A reduction in target catch rates is an issue that has arisen from preliminary analyses of MMED use in Nordic 264 gear. Although sample sizes are small, these results have cast some

doubt as to whether the MMED would be suitable for surveys with a primary objective of estimating abundance, as opposed to collecting biological samples. If data collected during testing of the modified-Cobb MMED continues to indicate reduced catch rates, SWFSC would continue testing to explore whether it is possible to calculate reliable conversion factors to equate catches when using the MMED to catches when it was not. If this is not possible, then use of the MMED for certain surveys may compromise primary research objectives. Therefore, use of the MMED may be considered not practicable

Analysis of Bycatch Patterns

In addition, SWFSC plans to explore patterns in past marine mammal bycatch in its fisheries research surveys to better understand what factors (e.g., oceanographic conditions) might increase the likelihood of take. SWFSC staff have been using predictive machine-learning methods (classification trees) for various applications; using similar methods, the SWFSC plans to examine research trawl data for any link between trawl variables and observed marine mammal bycatch. Some of the variables SWFSC is currently considering for this analysis are: moon phase, sky cover, pinger presence, trawl speed, vessel sonar use during trawl, use of deck lights, etc. SWFSC staff will also review historical fisheries research data to determine whether sufficient data exist for similar analysis. If take patterns emerge, the SWFSC will focus future research on reducing or eliminating high-risk factors in ways that enable scientifically important surveys to continue with minimized environmental impact.

Training

SWFSC anticipates that additional information on practices to avoid marine mammal interactions can be gleaned from training sessions and more systematic data collection standards. The SWFSC will conduct annual trainings for all chief scientists and other personnel who may

be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, recording of count and disturbance observations (relevant to AMLR surveys), completion of datasheets, and use of equipment. Some of these topics may be familiar to SWFSC staff, who may be professional biologists; the SWFSC shall determine the agenda for these trainings and ensure that all relevant staff have necessary familiarity with these topics.

SWFSC will also dedicate a portion of training to discussion of best professional judgment (which is recognized as an integral component of mitigation implementation; see “Proposed Mitigation”), including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful. We recognize that many factors come into play regarding decision-making at sea and that it is not practicable to simplify what are inherently variable and complex situational decisions into rules that may be defined on paper. However, it is our intent that use of best professional judgment be an iterative process from year to year, in which any at-sea decision-maker (i.e., responsible for decisions regarding the avoidance of marine mammal interactions with survey gear through the application of best professional judgment) learns from the prior experience of all relevant SWFSC personnel (rather than from solely their own experience). The outcome should be increased transparency in decision-making processes where best professional judgment is appropriate and, to the extent possible, some degree of standardization across common situations, with an ultimate goal of reducing marine mammal interactions. It is the responsibility of the SWFSC to facilitate such exchange.

Handling Procedures and Data Collection

Improved standardization of handling procedures were discussed previously in “Proposed Mitigation.” In addition to the benefits implementing these protocols are believed to have on the animals through increased post-release survival, SWFSC believes adopting these protocols for data collection will also increase the information on which “serious injury” determinations (NMFS, 2012a, b) are based and improve scientific knowledge about marine mammals that interact with fisheries research gears and the factors that contribute to these interactions. SWFSC personnel will be provided standard guidance and training regarding handling of marine mammals, including how to identify different species, bring an individual aboard a vessel, assess the level of consciousness, remove fishing gear, return an individual to water and log activities pertaining to the interaction.

SWFSC will record interaction information on either existing data forms created by other NMFS programs (e.g., see Appendix B.2 of SWFSC’s application) or will develop their own standardized forms. To aid in serious injury determinations and comply with the current NMFS Serious Injury Guidelines (NMFS, 2012a, b), researchers will also answer a series of supplemental questions on the details of marine mammal interactions (see Appendix B.3 of SWFSC’s application).

Finally, for any marine mammals that are killed during fisheries research activities, scientists will collect data and samples pursuant to the SWFSC MMPA and ESA research and salvage permit and to the “Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes on SWFSC Research Cruises” (see Appendix B.4 of SWFSC’s application).

Reporting

As is normally the case, SWFSC will coordinate with the relevant stranding coordinators for any unusual marine mammal behavior and any stranding, beached live/dead, or floating

marine mammals that are encountered during field research activities. The SWFSC will follow a phased approach with regard to the cessation of its activities and/or reporting of such events, as described in the proposed regulatory texts following this preamble. In addition, Chief Scientists (or cruise leader, CS) will provide reports to SWFSC leadership and to the Office of Protected Resources (OPR) by event, survey leg, and cruise. As a result, when marine mammals interact with survey gear, whether killed or released alive, a report provided by the CS will fully describe any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling. The circumstances of these events are critical in enabling SWFSC and OPR to better evaluate the conditions under which takes are most likely occur. We believe in the long term this will allow the avoidance of these types of events in the future.

The SWFSC will submit annual summary reports to OPR including: (1) annual line-kilometers surveyed during which the EK60, ME70, SX90 (or equivalent sources) were predominant (see “Estimated Take by Acoustic Harassment” for further discussion), specific to each region; (2) summary information regarding use of all longline (including bottom and vertical lines) and trawl (including bottom trawl) gear, including number of sets, hook hours, tows, etc., specific to each region and gear; (3) accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why; (4) summary information related to any on-ice disturbance of pinnipeds, including event-specific total counts of animals present, counts of reactions according to the three-point scale shown in Table 26, and distance of closest approach; (5) a written evaluation of the effectiveness of SWFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional judgment

and suggestions for changes to the mitigation strategies, if any; and (6) updates as appropriate regarding the development/implementation of MMEDs and analysis of bycatch patterns. The period of reporting will be a calendar year and the report must be submitted not less than ninety days following the end of a calendar year. Submission of this information is in service of an adaptive management framework allowing NMFS to make appropriate modifications to mitigation and/or monitoring strategies, as necessary, during the proposed five-year period of validity for these regulations.

NMFS has established a formal incidental take reporting system, the Protected Species Incidental Take (PSIT) database, requiring that incidental takes of protected species be reported within 48 hours of the occurrence. The PSIT generates automated messages to NMFS leadership and other relevant staff, alerting them to the event and to the fact that updated information describing the circumstances of the event has been inputted to the database. The PSIT and CS reports represent not only valuable real-time reporting and information dissemination tools, but also serve as an archive of information that may be mined in the future to study why takes occur by species, gear, region, etc.

SWFSC will also collect and report all necessary data, to the extent practicable given the primacy of human safety and the well-being of captured or entangled marine mammals, to facilitate serious injury (SI) determinations for marine mammals that are released alive. SWFSC will require that the CS complete data forms (already developed and used by commercial fisheries observer programs) and address supplemental questions, both of which have been developed to aid in SI determinations. SWFSC understands the critical need to provide as much relevant information as possible about marine mammal interactions to inform decisions regarding SI determinations. In addition, the SWFSC will perform all necessary reporting to

ensure that any incidental M/SI is incorporated as appropriate into relevant SARs.

Adaptive Management

The final regulations governing the take of marine mammals incidental to SWFSC fisheries research survey operations in three specified geographical regions would contain an adaptive management component. The inclusion of an adaptive management component will be both valuable and necessary within the context of five-year regulations for activities that have been associated with marine mammal mortality.

The reporting requirements associated with these proposed rules are designed to provide OPR with monitoring data from the previous year to allow consideration of whether any changes are appropriate. OPR and the SWFSC will meet annually to discuss the monitoring reports and current science and whether mitigation or monitoring modifications are appropriate. The use of adaptive management allows OPR to consider new information from different sources to determine (with input from the SWFSC regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) results from monitoring reports, as required by MMPA authorizations; (2) results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There are no relevant subsistence uses of marine mammals implicated by these actions, in any of the three specified geographical regions for which we propose rulemakings. Therefore, we have determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

There are multiple marine mammal species listed under the ESA with confirmed or possible occurrence in the proposed specified geographical regions (see Tables 3-5). The proposed authorization of incidental take pursuant to the SWFSC's specified activity would not affect any designated critical habitat. OPR has initiated consultation with NMFS' West Coast Regional Office under section 7 of the ESA on the promulgation of five-year regulations and the subsequent issuance of LOAs to SWFSC under section 101(a)(5)(A) of the MMPA. This consultation will be concluded prior to issuing any final rule.

National Environmental Policy Act (NEPA)

The SWFSC has prepared a Draft Environmental Assessment (EA; Draft Programmatic Environmental Assessment for Fisheries Research Conducted and Funded by the Southwest Fisheries Science Center) in accordance with NEPA and the regulations published by the Council on Environmental Quality. It is posted on the Internet at: www.nmfs.noaa.gov/pr/permits/incidental/research.htm. We have independently evaluated the Draft EA and are proposing to adopt it. We may prepare a separate NEPA analysis and incorporate relevant portions of SWFSC's EA by reference. Information in SWFSC's application, EA and this notice collectively provide the environmental information related to proposed issuance of these regulations for public review and comment. We will review all comments submitted in response to this notice as we complete the NEPA process, including a

decision of whether to sign a Finding of No Significant Impact, prior to a final decision on the incidental take authorization request.

Request for Information

NMFS requests interested persons to submit comments, information, and suggestions concerning the SWFSC request and the proposed regulations (see ADDRESSES). All comments will be reviewed and evaluated as we prepare final rules and make final determinations on whether to issue the requested authorizations. This notice and referenced documents provide all environmental information relating to our proposed action for public review.

Classification

Pursuant to the procedures established to implement Executive Order 12866, the Office of Management and Budget has determined that this proposed rule is not significant.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. NMFS is the sole entity that would be subject to the requirements in these proposed regulations, and NMFS is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid OMB control number. This proposed rule contains collection-of-

information requirements subject to the provisions of the PRA. These requirements have been approved by OMB under control number 0648-0151 and include applications for regulations, subsequent LOAs, and reports. Send comments regarding any aspect of this data collection, including suggestions for reducing the burden, to NMFS and the OMB Desk Officer (see Addresses).

List of Subjects in 50 CFR Part 219

Exports, Fish, Imports, Indians, Labeling, Marine mammals, Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: February 5, 2015.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs,

National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 219 is proposed to be added as follows:

PART 219 – REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

Subpart A – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries Research in the California Current

Sec.

219.1 Specified activity and specified geographical region.

219.2 [Reserved]

219.3 Permissible methods of taking.

219.4 Prohibitions.

219.5 Mitigation requirements.

219.6 Requirements for monitoring and reporting.

219.7 Letters of Authorization.

219.8 Renewals and modifications of Letters of Authorization.

219.9 [Reserved]

219.10 [Reserved]

Subpart B – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries Research in the Eastern Tropical Pacific

Sec.

219.11 Specified activity and specified geographical region.

219.12 [Reserved]

219.13 Permissible methods of taking.

219.14 Prohibitions.

219.15 Mitigation requirements.

219.16 Requirements for monitoring and reporting.

219.17 Letters of Authorization.

219.18 Renewals and modifications of Letters of Authorization.

219.19 [Reserved]

219.20 [Reserved]

Subpart C – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries
Research in the Antarctic

Sec.

219.21 Specified activity and specified geographical region.

219.22 [Reserved]

219.23 Permissible methods of taking.

219.24 Prohibitions.

219.25 Mitigation requirements.

219.26 Requirements for monitoring and reporting.

219.27 Letters of Authorization.

219.28 Renewals and modifications of Letters of Authorization.

219.29 [Reserved]

219.30 [Reserved]

Authority: 16 U.S.C. 1361 et seq.

Subpart A – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries
Research in the California Current

§ 219.1 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the National Marine Fisheries Service's (NMFS) Southwest Fisheries Science Center (SWFSC) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to research survey program operations.

(b) The taking of marine mammals by SWFSC may be authorized in a Letter of Authorization (LOA) only if it occurs within the California Current Ecosystem.

§ 219.2 [Reserved]

§ 219.3 Permissible methods of taking.

(a) Under LOAs issued pursuant to §§ 216.106 and 219.7 of this chapter, the Holder of the LOA (hereinafter "SWFSC") may incidentally, but not intentionally, take marine mammals within the area described in § 219.1(b) of this chapter, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

(b) The incidental take of marine mammals under the activities identified in § 219.1(a) of this chapter is limited to the indicated number of takes on an annual basis (by Level B harassment) or over the five-year period of validity of these regulations (by mortality) of the following species:

(1) Level B harassment:

(i) Cetaceans:

(A) Gray whale (Eschrichtius robustus) – 346;

(B) Humpback whale (Megaptera novaeangliae) – 14;

- (C) Minke whale (Balaenoptera acutorostrata) – 13;
- (D) Sei whale (Balaenoptera borealis) – 1;
- (E) Fin whale (Balaenoptera physalus) – 33;
- (F) Blue whale (Balaenoptera musculus) – 24;
- (G) Sperm whale (Physeter macrocephalus) – 65;
- (H) Pygmy or dwarf sperm whale (Kogia spp.) – 42;
- (I) Cuvier’s beaked whale (Ziphius cavirostris) – 146;
- (J) Baird’s beaked whale (Berardius bairdii) – 34;
- (K) Hubbs’, Blainville’s, ginkgo-toothed, Perrin’s, lesser, or Stejneger’s beaked whales (Mesoplodon spp.) – 40;
- (L) Bottlenose dolphin (Tursiops truncatus) – 32;
- (M) Striped dolphin (Stenella coeruleoalba) – 301;
- (N) Long-beaked common dolphin (Delphinis capensis) – 348;
- (O) Short-beaked common dolphin (Delphinis delphis) – 5,592;
- (P) Pacific white-sided dolphin (Lagenorhynchus obliquidens) – 378;
- (Q) Northern right whale dolphin (Lissodelphis borealis) – 176;
- (R) Risso’s dolphin (Grampus griseus) – 188;
- (S) Killer whale (Orcinus orca) – 13;
- (T) Short-finned pilot whale (Globicephala macrorhynchus) – 12;
- (U) Harbor porpoise (Phocoena phocoena) – 682; and
- (V) Dall’s porpoise (Phocoenoides dalli) – 1,365.
- (ii) Pinnipeds:
- (A) Guadalupe fur seal (Arctocephalus philippii townsendi) – 134;

- (B) Northern fur seal (Callorhinus ursinus), California stock – 236;
- (C) Northern fur seal, Pribilof Islands/Eastern Pacific stock – 11,555;
- (D) California sea lion (Zalophus californianus) – 4,302;
- (E) Steller sea lion (Eumetopias jubatus) – 1,055;
- (F) Harbor seal (Phoca vitulina) – 910; and
- (G) Northern elephant seal (Mirounga angustirostris) – 4,743.
- (2) Mortality (midwater trawl gear only):
 - (i) Cetaceans:
 - (A) Bottlenose dolphin (California, Oregon, and Washington offshore stock) – 8;
 - (B) Bottlenose dolphin (California coastal stock) – 3;
 - (C) Striped dolphin – 11;
 - (D) Long-beaked common dolphin – 11;
 - (E) Short-beaked common dolphin – 11;
 - (F) Pacific white-sided dolphin – 35;
 - (G) Northern right whale dolphin – 10;
 - (H) Risso's dolphin – 11;
 - (I) Harbor porpoise – 5;
 - (J) Dall's porpoise – 5;
 - (K) Unidentified cetacean (Family Delphinidae or Family Phocoenidae) – 1.
 - (ii) Pinnipeds:
 - (A) Northern fur seal – 5;
 - (B) California sea lion – 20;
 - (C) Steller sea lion – 9;

- (D) Harbor seal – 9;
- (E) Northern elephant seal – 5; and
- (F) Unidentified pinniped – 1.
- (3) Mortality (pelagic longline gear only):
 - (i) Cetaceans:
 - (A) Pygmy or dwarf sperm whale – 1;
 - (B) Bottlenose dolphin – 1;
 - (C) Striped dolphin – 1;
 - (D) Long-beaked common dolphin – 1;
 - (E) Short-beaked common dolphin – 1;
 - (F) Risso’s dolphin – 1; and
 - (G) Short-finned pilot whale – 1.
 - (ii) Pinnipeds:
 - (A) California sea lion – 5;
 - (B) Steller sea lion – 1; and
 - (C) Unidentified pinniped – 1.

§ 219.4 Prohibitions.

Notwithstanding takings contemplated in § 219.1 of this chapter and authorized by a LOA issued under §§ 216.106 and 219.7 of this chapter, no person in connection with the activities described in § 219.1 of this chapter may:

- (a) Take any marine mammal not specified in § 219.3(b) of this chapter;
- (b) Take any marine mammal specified in § 219.3(b) of this chapter in any manner other than as specified;

(c) Take a marine mammal specified in § 219.3(b) of this chapter if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal;

(d) Take a marine mammal specified in § 219.3(b) of this chapter if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses; or

(e) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under §§ 216.106 and 219.7 of this chapter.

§ 219.5 Mitigation requirements.

When conducting the activities identified in § 219.1(a) of this chapter, the mitigation measures contained in any LOA issued under §§ 216.106 and 219.7 of this chapter must be implemented. These mitigation measures shall include but are not limited to:

(a) General conditions:

(1) SWFSC shall take all necessary measures to coordinate and communicate in advance of each specific survey with the National Oceanic and Atmospheric Administration's (NOAA) Office of Marine and Aviation Operations (OMAO) or other relevant parties on non-NOAA platforms to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed upon.

(2) SWFSC shall coordinate and conduct briefings at the outset of each survey and as necessary between ship's crew (Commanding Officer/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(3) SWFSC shall coordinate as necessary on a daily basis during survey cruises with OMAO personnel or other relevant personnel on non-NOAA platforms to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

(4) When deploying any type of sampling gear at sea, SWFSC shall at all times monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

(5) SWFSC shall implement handling and/or disentanglement protocols as specified in the guidance provided to SWFSC survey personnel (“Identification, Handling and Release of Protected Species”).

(b) Midwater trawl survey protocols:

(1) SWFSC shall conduct trawl operations as soon as is practicable upon arrival at the sampling station.

(2) SWFSC shall initiate marine mammal watches (visual observation) no less than thirty minutes prior to sampling. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) SWFSC shall implement the “move-on rule.” If one or more marine mammals are observed within 1 nm of the planned location in the thirty minutes before setting the trawl gear, SWFSC shall transit to a different section of the sampling area to maintain a minimum set distance of 1 nm from the observed marine mammals. If, after moving on, marine mammals remain within 1 nm, SWFSC may decide to move again or to skip the station. SWFSC may use

best professional judgment in making this decision but may not elect to conduct midwater trawl survey activity when animals remain within the 1-nm zone.

(4) SWFSC shall maintain visual monitoring effort during the entire period of time that midwater trawl gear is in the water (i.e., throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, SWFSC shall take the most appropriate action to avoid marine mammal interaction. SWFSC may use best professional judgment in making this decision.

(5) If trawling operations have been suspended because of the presence of marine mammals, SWFSC may resume trawl operations when practicable only when the animals are believed to have departed the 1 nm area. SWFSC may use best professional judgment in making this determination.

(6) SWFSC shall implement standard survey protocols, including maximum tow durations of thirty minutes at target depth and maximum tow distance of 3 nm and shall carefully empty the trawl as quickly as possible upon retrieval. Trawl nets must be cleaned prior to deployment.

(7) SWFSC must install and use a marine mammal excluder device at all times when the Nordic 264 trawl net or other net for which the device is appropriate is used.

(8) SWFSC must install and use acoustic deterrent devices whenever any midwater trawl net is used, with two to four devices placed along the footrope and/or headrope of the net. SWFSC must ensure that the devices are operating properly before deploying the net.

(c) Pelagic longline survey protocols:

(1) SWFSC shall deploy longline gear as soon as is practicable upon arrival at the sampling station.

(2) SWFSC shall initiate marine mammal watches (visual observation) no less than thirty minutes prior to both deployment and retrieval of the longline gear. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) SWFSC shall implement the “move-on rule.” If one or more marine mammals are observed within 1 nm of the planned location in the thirty minutes before gear deployment, SWFSC shall transit to a different section of the sampling area to maintain a minimum set distance of 1 nm from the observed marine mammals. If, after moving on, marine mammals remain within 1 nm, SWFSC may decide to move again or to skip the station. SWFSC may use best professional judgment in making this decision but may not elect to conduct pelagic longline survey activity when animals remain within the 1-nm zone. Implementation of the “move-on rule” is not required upon observation of five or fewer California sea lions.

(4) SWFSC shall maintain visual monitoring effort during the entire period of gear deployment or retrieval. If marine mammals are sighted before the gear is fully deployed or retrieved, SWFSC shall take the most appropriate action to avoid marine mammal interaction. SWFSC may use best professional judgment in making this decision.

(5) If deployment or retrieval operations have been suspended because of the presence of marine mammals, SWFSC may resume such operations when practicable only when the animals are believed to have departed the 1 nm area. SWFSC may use best professional judgment in making this decision.

(6) SWFSC shall implement standard survey protocols, including maximum soak duration of four hours and a prohibition on chumming.

§ 219.6 Requirements for monitoring and reporting.

(a) Visual monitoring program:

(1) Dedicated marine mammal visual monitoring, conducted by trained SWFSC personnel with no other responsibilities during the monitoring period, shall occur (1) for a minimum of thirty minutes prior to deployment of midwater trawl and pelagic longline gear; (2) throughout deployment of gear and active fishing of all research gears; (3) for a minimum of thirty minutes prior to retrieval of pelagic longline gear; and (4) throughout retrieval of all research gear.

(2) Marine mammal watches shall be conducted by watch-standers (those navigating the vessel and/or other crew) at all times when the vessel is being operated.

(b) Acoustic monitoring – SWFSC shall log passive acoustic data before and during the conduct of each midwater trawl.

(c) Marine mammal excluder device (MMED) – SWFSC shall conduct an evaluation of the feasibility of MMED development for the modified-Cobb midwater trawl net.

(d) Analysis of bycatch patterns – SWFSC shall conduct an analysis of past bycatch patterns in order to better understand what factors might increase the likelihood of incidental take in research survey gear. This shall include an analysis of research trawl data for any link between trawl variables and observed marine mammal bycatch, as well as a review of historical fisheries research data to determine whether sufficient data exist for similar analysis.

(e) Training:

(1) SWFSC must conduct annual training for all chief scientists and other personnel who may be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring

protocols, marine mammal identification, completion of datasheets, and use of equipment.

SWFSC may determine the agenda for these trainings.

(2) SWFSC shall also dedicate a portion of training to discussion of best professional judgment, including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful.

(f) Handling procedures and data collection:

(1) SWFSC must develop and implement standardized marine mammal handling, disentanglement, and data collection procedures. These standard procedures will be subject to approval by NMFS' Office of Protected Resources (OPR).

(2) When practicable, for any marine mammal interaction involving the release of a live animal, SWFSC shall collect necessary data to facilitate a serious injury determination.

(3) SWFSC shall provide its relevant personnel with standard guidance and training regarding handling of marine mammals, including how to identify different species, bring an individual aboard a vessel, assess the level of consciousness, remove fishing gear, return an individual to water, and log activities pertaining to the interaction.

(4) SWFSC shall record such data on standardized forms, which will be subject to approval by OPR. SWFSC shall also answer a standard series of supplemental questions regarding the details of any marine mammal interaction.

(g) Reporting:

(1) SWFSC shall report all incidents of marine mammal interaction to NMFS' Protected Species Incidental Take database within 48 hours of occurrence.

(2) SWFSC shall provide written reports to OPR following any marine mammal interaction (animal captured or entangled in research gear) and/or survey leg or cruise,

summarizing survey effort on the leg or cruise. In the event of a marine mammal interaction, these reports shall include full descriptions of any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling.

(3) Annual reporting:

(i) SWFSC shall submit an annual summary report to OPR not later than ninety days following the end of a calendar year, with the reporting period being a given calendar year.

(ii) These reports shall contain, at minimum, the following:

(A) Annual line-kilometers surveyed during which the EK60, ME70, SX90 (or equivalent sources) were predominant;

(B) Summary information regarding use of all longline (including bottom and vertical lines) and trawl (including bottom trawl) gear, including number of sets, hook hours, tows, etc., specific to each gear;

(C) Accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why;

(D) A written evaluation of the effectiveness of SWFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional judgment and suggestions for changes to the mitigation strategies, if any;

(E) Final outcome of serious injury determinations for all incidents of marine mammal interactions where the animal(s) were released alive; and

(F) Updates as appropriate regarding the development/implementation of MMEDs and analysis of bycatch patterns.

(h) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 219.1(a) of this chapter clearly causes the take of a marine mammal in a prohibited manner, SWFSC shall immediately cease the specified activities and report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS. The report must include the following information:

- (i) Time, date, and location (latitude/longitude) of the incident;
- (ii) Description of the incident;
- (iii) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility);
- (iv) Description of all marine mammal observations in the 24 hours preceding the incident;
- (v) Species identification or description of the animal(s) involved;
- (vi) Status of all sound source use in the 24 hours preceding the incident;
- (vii) Water depth;
- (viii) Fate of the animal(s); and
- (ix) Photographs or video footage of the animal(s).

Activities shall not resume until OPR is able to review the circumstances of the prohibited take. OPR shall work with SWFSC to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SWFSC may not resume their activities until notified by OPR.

(2) In the event that SWFSC discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), SWFSC shall immediately report the

incident to OPR and the West Coast Regional Stranding Coordinator, NMFS. The report must include the information identified in § 219.6(h)(1) of this section. Activities may continue while OPR reviews the circumstances of the incident. OPR will work with SWFSC to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that SWFSC discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 219.1(a) of this chapter (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), SWFSC shall report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. SWFSC shall provide photographs or video footage or other documentation of the stranded animal sighting to OPR.

§ 219.7 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, SWFSC must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, SWFSC may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, SWFSC must apply for and obtain a modification of the LOA as described in § 219.18 of this chapter.

(e) The LOA shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (i.e., mitigation) on the

species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.

(g) Notice of issuance or denial of an LOA shall be published in the Federal Register within thirty days of a determination.

§ 219.8 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under §§ 216.106 and 219.7 of this chapter for the activity identified in § 219.1(a) of this chapter shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in § 219.8(c)(1) of this chapter), and

(2) OPR determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For an LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in § 219.8(c)(1) of this chapter) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), OPR may publish a notice of proposed LOA in the Federal Register, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 and 219.7 of this chapter for the activity identified in § 219.11(a) of this chapter may be modified by OPR under the following circumstances:

(1) Adaptive Management – OPR may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with SWFSC regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from SWFSC’s monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, OPR will publish a notice of proposed LOA in the Federal Register and solicit public comment.

(2) Emergencies – If OPR determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 219.12(b) of this chapter, an LOA may be modified without prior notice or opportunity for public comment.

Notice would be published in the Federal Register within thirty days of the action.

§ 219.9 [Reserved]

§ 219.10 [Reserved]

Subpart B – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries

Research in the Eastern Tropical Pacific

§ 219.11 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the National Marine Fisheries Service's (NMFS) Southwest Fisheries Science Center (SWFSC) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to research survey program operations.

(b) The taking of marine mammals by SWFSC may be authorized in a Letter of Authorization (LOA) only if it occurs within the Eastern Tropical Pacific.

§ 219.12 [Reserved]

§ 219.13 Permissible methods of taking.

(a) Under LOAs issued pursuant to §§ 216.106 and 219.17 of this chapter, the Holder of the LOA (hereinafter "SWFSC") may incidentally, but not intentionally, take marine mammals within the area described in § 219.11(b) of this chapter, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

(b) The incidental take of marine mammals under the activities identified in § 219.11(a) of this chapter is limited to the indicated number of takes on an annual basis (by Level B harassment) or over the five-year period of validity of these regulations (by mortality) of the following species:

(1) Level B harassment:

(i) Cetaceans:

(A) Humpback whale (Megaptera novaeangliae) – 1;

- (B) Bryde's whale (Balaenoptera edeni) – 4;
 - (C) Blue whale (Balaenoptera musculus) – 2;
 - (D) Sperm whale (Physeter macrocephalus) – 4;
 - (E) Dwarf sperm whale (Kogia sima) – 14;
 - (F) Cuvier's beaked whale (Ziphius cavirostris) – 24;
 - (G) Longman's beaked whale (Indopacetus pacificus) – 1;
 - (H) Blainville's, ginkgo-toothed, or lesser beaked whales (Mesoplodon spp.) – 30;
 - (I) Rough-toothed dolphin (Steno bredanensis) – 45;
 - (J) Bottlenose dolphin (Tursiops truncatus) – 139;
 - (K) Striped dolphin (Stenella coeruleoalba) – 401;
 - (L) Pantropical spotted dolphin (Stenella attenuata) – 1,088;
 - (M) Spinner dolphin (Stenella longirostris) – 442;
 - (N) Long-beaked common dolphin (Delphinis capensis) – 173;
 - (O) Short-beaked common dolphin (Delphinis delphis) – 1,300;
 - (P) Fraser's dolphin (Lagenodelphis hosei) – 121;
 - (Q) Dusky dolphin (Lagenorhynchus obscurus) – 18;
 - (R) Risso's dolphin (Grampus griseus) – 46;
 - (S) Melon-headed whale (Peponocephala electra) – 19;
 - (T) Pygmy killer whale (Feresa attenuata) – 17;
 - (U) False killer whale (Pseudorca crassidens) – 17;
 - (V) Killer whale (Orcinus orca) – 3; and
 - (W) Short-finned pilot whale (Globicephala macrorhynchus) – 723.
- (ii) Pinnipeds:

(A) Guadalupe fur seal (Arctocephalus philippii townsendi) – 66;

(B) California sea lion (Zalophus californianus) – 1,442;

(C) South American sea lion (Otaria byronia) – 1,442; and

(D) Northern elephant seal (Mirounga angustirostris) – 3,248.

(2) Mortality (pelagic longline gear only):

(i) Cetaceans:

(A) Dwarf sperm whale – 1;

(B) Rough-toothed dolphin – 1;

(C) Bottlenose dolphin – 1;

(D) Striped dolphin – 1;

(E) Pantropical spotted dolphin – 1;

(F) Long-beaked common dolphin – 1;

(G) Short-beaked common dolphin – 1;

(H) Risso's dolphin – 1;

(I) False killer whale – 1; and

(J) Short-finned pilot whale – 1.

(ii) Pinnipeds:

(A) California sea lion – 5;

(B) South American sea lion – 5; and

(C) Unidentified pinniped – 1.

§ 219.14 Prohibitions.

Notwithstanding takings contemplated in § 219.11 of this chapter and authorized by a LOA issued under §§ 216.106 and 219.17 of this chapter, no person in connection with the

activities described in § 219.11 of this chapter may:

- (a) Take any marine mammal not specified in § 219.13(b) of this chapter;
- (b) Take any marine mammal specified in § 219.13(b) in any manner other than as specified;
- (c) Take a marine mammal specified in § 219.13(b) of this chapter if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal;
- (d) Take a marine mammal specified in § 219.13(b) if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses; or
- (e) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under §§ 216.106 and 219.17 of this chapter.

§ 219.15 Mitigation requirements.

When conducting the activities identified in § 219.11(a), the mitigation measures contained in any LOA issued under §§ 216.106 and 219.17 of this chapter must be implemented. These mitigation measures shall include but are not limited to:

- (a) General conditions:
 - (1) SWFSC shall take all necessary measures to coordinate and communicate in advance of each specific survey with the National Oceanic and Atmospheric Administration's (NOAA) Office of Marine and Aviation Operations (OMAO) or other relevant parties on non-NOAA platforms to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed upon.

(2) SWFSC shall coordinate and conduct briefings at the outset of each survey and as necessary between ship's crew (Commanding Officer/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(3) SWFSC shall coordinate as necessary on a daily basis during survey cruises with OMAO personnel or other relevant personnel on non-NOAA platforms to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

(4) When deploying any type of sampling gear at sea, SWFSC shall at all times monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

(5) SWFSC shall implement handling and/or disentanglement protocols as specified in the guidance provided to SWFSC survey personnel ("Identification, Handling and Release of Protected Species").

(b) Pelagic longline survey protocols:

(1) SWFSC shall deploy longline gear as soon as is practicable upon arrival at the sampling station.

(2) SWFSC shall initiate marine mammal watches (visual observation) no less than thirty minutes prior to both deployment and retrieval of the longline gear. Marine mammal watches shall be conducted by scanning the surrounding waters with the naked eye and rangefinding binoculars (or monocular). During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

(3) SWFSC shall implement the "move-on rule." If one or more marine mammals are

observed within 1 nm of the planned location in the thirty minutes before gear deployment, SWFSC shall transit to a different section of the sampling area to maintain a minimum set distance of 1 nm from the observed marine mammals. If, after moving on, marine mammals remain within 1 nm, SWFSC may decide to move again or to skip the station. SWFSC may use best professional judgment in making this decision but may not elect to conduct pelagic longline survey activity when animals remain within the 1-nm zone.

(4) SWFSC shall maintain visual monitoring effort during the entire period of gear deployment or retrieval. If marine mammals are sighted before the gear is fully deployed or retrieved, SWFSC shall take the most appropriate action to avoid marine mammal interaction. SWFSC may use best professional judgment in making this decision.

(5) If deployment or retrieval operations have been suspended because of the presence of marine mammals, SWFSC may resume such operations when practicable only when the animals are believed to have departed the 1 nm area. SWFSC may use best professional judgment in making this determination.

(6) SWFSC shall implement standard survey protocols, including maximum soak duration of four hours and a prohibition on chumming.

§ 219.16 Requirements for monitoring and reporting.

(a) Visual monitoring program:

(1) Dedicated marine mammal visual monitoring, conducted by trained SWFSC personnel with no other responsibilities during the monitoring period, shall occur (1) for a minimum of thirty minutes prior to deployment of pelagic longline gear; (2) throughout deployment of gear and active fishing of all research gears; (3) for a minimum of thirty minutes prior to retrieval of pelagic longline gear; and (4) throughout retrieval of all research gear.

(2) Marine mammal watches shall be conducted by watch-standers (those navigating the vessel and/or other crew) at all times when the vessel is being operated.

(b) Training:

(1) SWFSC must conduct annual training for all chief scientists and other personnel who may be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, completion of datasheets, and use of equipment. SWFSC may determine the agenda for these trainings.

(2) SWFSC shall also dedicate a portion of training to discussion of best professional judgment, including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful.

(c) Handling procedures and data collection:

(1) SWFSC must develop and implement standardized marine mammal handling, disentanglement, and data collection procedures. These standard procedures will be subject to approval by NMFS' Office of Protected Resources (OPR).

(2) When practicable, for any marine mammal interaction involving the release of a live animal, SWFSC shall collect necessary data to facilitate a serious injury determination.

(3) SWFSC shall provide its relevant personnel with standard guidance and training regarding handling of marine mammals, including how to identify different species, bring an individual aboard a vessel, assess the level of consciousness, remove fishing gear, return an individual to water, and log activities pertaining to the interaction.

(4) SWFSC shall record such data on standardized forms, which will be subject to approval by NMFS' Office of Protected Resources (OPR). SWFSC shall also answer a standard

series of supplemental questions regarding the details of any marine mammal interaction.

(d) Reporting:

(1) SWFSC shall report all incidents of marine mammal interaction to NMFS' Protected Species Incidental Take database within 48 hours of occurrence.

(2) SWFSC shall provide written reports to OPR following any marine mammal interaction (animal captured or entangled in research gear) and/or survey leg or cruise, summarizing survey effort on the leg or cruise. In the event of a marine mammal interaction, these reports shall include full descriptions of any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling.

(3) Annual reporting:

(i) SWFSC shall submit an annual summary report to OPR not later than ninety days following the end of a calendar year, with the reporting period being a given calendar year.

(ii) These reports shall contain, at minimum, the following:

(A) Annual line-kilometers surveyed during which the EK60, ME70, SX90 (or equivalent sources) were predominant;

(B) Summary information regarding use of all longline gear, including number of sets, hook hours, etc.;

(C) Accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why;

(D) A written evaluation of the effectiveness of SWFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional

judgment and suggestions for changes to the mitigation strategies, if any; and

(E) Final outcome of serious injury determinations for all incidents of marine mammal interactions where the animal(s) were released alive.

(e) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 219.11(a) of this chapter clearly causes the take of a marine mammal in a prohibited manner, SWFSC shall immediately cease the specified activities and report the incident to OPR. Activities shall not resume until OPR is able to review the circumstances of the prohibited take. OPR shall work with SWFSC to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SWFSC may not resume their activities until notified by OPR. The report must include the following information:

- (i) Time, date, and location (latitude/longitude) of the incident;
 - (ii) Description of the incident;
 - (iii) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility);
 - (iv) Description of all marine mammal observations in the 24 hours preceding the incident;
 - (v) Species identification or description of the animal(s) involved;
 - (vi) Status of all sound source use in the 24 hours preceding the incident;
 - (vii) Water depth;
 - (viii) Fate of the animal(s); and
 - (ix) Photographs or video footage of the animal(s).
- (2) In the event that SWFSC discovers an injured or dead marine mammal and

determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), SWFSC shall immediately report the incident to OPR. The report must include the same information identified in § 219.16(e)(1) of this section. Activities may continue while OPR reviews the circumstances of the incident. OPR will work with SWFSC to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that SWFSC discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 219.11(a) of this chapter (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), SWFSC shall report the incident to OPR within 24 hours of the discovery. SWFSC shall provide photographs or video footage or other documentation of the stranded animal sighting to OPR.

§ 219.17 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, SWFSC must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, SWFSC may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, SWFSC must apply for and obtain a modification of the LOA as described in § 219.18 of this chapter.

(e) The LOA shall set forth:

- (1) Permissible methods of incidental taking;
 - (2) Means of effecting the least practicable adverse impact (i.e., mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and
 - (3) Requirements for monitoring and reporting.
- (f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.
- (g) Notice of issuance or denial of an LOA shall be published in the Federal Register within thirty days of a determination.

§ 219.18 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under §§ 216.106 and 219.17 of this chapter for the activity identified in § 219.11(a) of this chapter shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in § 219.18(c)(1) of this chapter), and

(2) OPR determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For an LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in § 219.18(c)(1) of this chapter) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), OPR may publish a notice of proposed LOA in the

Federal Register, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 and 219.17 of this chapter for the activity identified in § 219.11(a) of this chapter may be modified by OPR under the following circumstances:

(1) Adaptive Management – OPR may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with SWFSC regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from SWFSC's monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, OPR will publish a notice of proposed LOA in the Federal Register and solicit public comment.

(2) Emergencies – If OPR determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 219.12(b) of this chapter, an LOA may be modified without prior notice or opportunity for public comment.

Notice would be published in the Federal Register within thirty days of the action.

§ 219.19 [Reserved]

§ 219.20 [Reserved]

Subpart C – Taking Marine Mammals Incidental to Southwest Fisheries Science Center Fisheries Research in the Antarctic

§ 219.21 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the National Marine Fisheries Service's (NMFS) Southwest Fisheries Science Center (SWFSC) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to research survey program operations.

(b) The taking of marine mammals by SWFSC may be authorized in a Letter of Authorization (LOA) only if it occurs within the Antarctic Marine Living Resources Ecosystem.

§ 219.22 [Reserved]

§ 219.23 Permissible methods of taking.

(a) Under LOAs issued pursuant to §§ 216.106 and 219.27 of this chapter, the Holder of the LOA (hereinafter "SWFSC") may incidentally, but not intentionally, take marine mammals within the area described in § 219.21(b) of this chapter, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

(b) The incidental take of marine mammals under the activities identified in § 219.21(a) of this chapter is limited to the indicated number of takes on an annual basis of the following species and is limited to Level B harassment:

(1) Cetaceans:

(i) Southern right whale (Eubalaena australis) – 1;

- (ii) Humpback whale (Megaptera novaeangliae) – 92;
 - (iii) Antarctic minke whale (Balaenoptera bonaerensis) – 6;
 - (iv) Fin whale (Balaenoptera physalus) – 114;
 - (v) Sperm whale (Physeter macrocephalus) – 3;
 - (vi) Arnoux' beaked whale (Berardius arnuxii) – 37;
 - (vii) Southern bottlenose whale (Hyperoodon planifrons) – 37;
 - (viii) Hourglass dolphin (Lagenorhynchus cruciger) – 12;
 - (ix) Killer whale (Orcinus orca) – 11;
 - (x) Long-finned pilot whale (Globicephala melas) – 43; and
 - (xi) Spectacled porpoise (Phocoena dioptrica) – 12.
- (2) Pinnipeds:
- (i) Antarctic fur seal (Arctocephalus philippii townsendi) – 553;
 - (ii) Southern elephant seal (Mirounga leonina) – 6;
 - (iii) Weddell seal (Leptonychotes weddellii) – 4;
 - (iv) Crabeater seal (Lobodon carcinophaga) – 7; and
 - (v) Leopard seal (Hydrurga leptonyx) – 5.

§ 219.24 Prohibitions.

Notwithstanding takings contemplated in § 219.21 of this chapter and authorized by a LOA issued under §§ 216.106 and 219.27 of this chapter, no person in connection with the activities described in § 219.21 of this chapter may:

- (a) Take any marine mammal not specified in § 219.23(b) of this chapter;
- (b) Take any marine mammal specified in § 219.23(b) in any manner other than as specified;

(c) Take a marine mammal specified in § 219.23(b) of this chapter if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal;

(d) Take a marine mammal specified in § 219.23(b) if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses; or

(e) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under § 216.106 and § 219.27 of this chapter.

§ 219.25 Mitigation requirements.

When conducting the activities identified in § 219.21(a), the mitigation measures contained in any LOA issued under §§ 216.106 and 219.27 of this chapter must be implemented. These mitigation measures shall include but are not limited to:

(a) General conditions:

(1) SWFSC shall take all necessary measures to coordinate and communicate in advance of each specific survey with the National Oceanic and Atmospheric Administration's (NOAA) Office of Marine and Aviation Operations (OMAO) or other relevant parties on non-NOAA platforms to ensure that all mitigation measures and monitoring requirements described herein, as well as the specific manner of implementation and relevant event-contingent decision-making processes, are clearly understood and agreed upon.

(2) SWFSC shall coordinate and conduct briefings at the outset of each survey and as necessary between ship's crew (Commanding Officer/master or designee(s), as appropriate) and scientific party in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(3) SWFSC shall coordinate as necessary on a daily basis during survey cruises with OMAO personnel or other relevant personnel on non-NOAA platforms to ensure that requirements, procedures, and decision-making processes are understood and properly implemented.

(4) When deploying any type of sampling gear at sea, SWFSC shall at all times monitor for any unusual circumstances that may arise at a sampling site and use best professional judgment to avoid any potential risks to marine mammals during use of all research equipment.

(5) SWFSC shall implement handling and/or disentanglement protocols as specified in the guidance provided to SWFSC survey personnel (“Identification, Handling and Release of Protected Species”).

(b) Trawl survey protocols – SWFSC shall conduct trawl operations as soon as is practicable upon arrival at the sampling station.

§ 219.26 Requirements for monitoring and reporting.

(a) Visual monitoring program:

(1) Marine mammal watches shall be conducted by watch-standers (those navigating the vessel and/or other crew) at all times when the vessel is being operated.

(2) SWFSC shall monitor any potential disturbance of pinnipeds on ice, paying particular attention to the distance at which different species of pinniped are disturbed. Disturbance shall be recorded according to a three-point scale representing increasing seal response to disturbance.

(b) Acoustic monitoring – SWFSC shall log passive acoustic data before and during the conduct of each trawl.

(c) Training:

(1) SWFSC must conduct annual training for all chief scientists and other personnel who

may be responsible for conducting dedicated marine mammal visual observations to explain mitigation measures and monitoring and reporting requirements, mitigation and monitoring protocols, marine mammal identification, recording of count and disturbance observations, completion of datasheets, and use of equipment. SWFSC may determine the agenda for these trainings.

(2) SWFSC shall also dedicate a portion of training to discussion of best professional judgment, including use in any incidents of marine mammal interaction and instructive examples where use of best professional judgment was determined to be successful or unsuccessful.

(d) Handling procedures and data collection:

(1) SWFSC must develop and implement standardized marine mammal handling, disentanglement, and data collection procedures. These standard procedures will be subject to approval by NMFS' Office of Protected Resources (OPR).

(2) When practicable, for any marine mammal interaction involving the release of a live animal, SWFSC shall collect necessary data to facilitate a serious injury determination.

(3) SWFSC shall provide its relevant personnel with standard guidance and training regarding handling of marine mammals, including how to identify different species, bring an individual aboard a vessel, assess the level of consciousness, remove fishing gear, return an individual to water, and log activities pertaining to the interaction.

(4) SWFSC shall record such data on standardized forms, which will be subject to approval by OPR. SWFSC shall also answer a standard series of supplemental questions regarding the details of any marine mammal interaction.

(e) Reporting:

(1) SWFSC shall report all incidents of marine mammal interaction to NMFS' Protected

Species Incidental Take database within 48 hours of occurrence.

(2) SWFSC shall provide written reports to OPR following any marine mammal interaction (animal captured or entangled in research gear) and/or survey leg or cruise, summarizing survey effort on the leg or cruise. In the event of a marine mammal interaction, these reports shall include full descriptions of any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling.

(3) Annual reporting:

(i) SWFSC shall submit an annual summary report to OPR not later than ninety days following the end of a calendar year, with the reporting period being a given calendar year.

(ii) These reports shall contain, at minimum, the following:

(A) Annual line-kilometers surveyed during which the EK60, ME70, SX90 (or equivalent sources) were predominant;

(B) Summary information regarding use of all trawl gear, including number of tows, etc.;

(C) Accounts of all incidents of marine mammal interactions, including circumstances of the event and descriptions of any mitigation procedures implemented or not implemented and why;

(D) Summary information related to any on-ice disturbance of pinnipeds, including event-specific total counts of animals present, counts of reactions according to a three-point scale of response severity (1 = alert; 2 = movement; 3 = flight), and distance of closest approach;

(E) A written evaluation of the effectiveness of SWFSC mitigation strategies in reducing the number of marine mammal interactions with survey gear, including best professional judgment and suggestions for changes to the mitigation strategies, if any; and

(F) Final outcome of serious injury determinations for all incidents of marine mammal interactions where the animal(s) were released alive.

(f) Reporting of injured or dead marine mammals:

(1) In the unanticipated event that the activity defined in § 219.21(a) of this chapter clearly causes the take of a marine mammal in a prohibited manner, SWFSC shall immediately cease the specified activities and report the incident to OPR. The report must include the following information:

- (i) Time, date, and location (latitude/longitude) of the incident;
- (ii) Description of the incident;
- (iii) Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility);
- (iv) Description of all marine mammal observations in the 24 hours preceding the incident;
- (v) Species identification or description of the animal(s) involved;
- (vi) Status of all sound source use in the 24 hours preceding the incident;
- (vii) Water depth;
- (viii) Fate of the animal(s); and
- (ix) Photographs or video footage of the animal(s).

Activities shall not resume until OPR is able to review the circumstances of the prohibited take. OPR shall work with SWFSC to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. SWFSC may not resume their activities until notified by OPR.

(2) In the event that SWFSC discovers an injured or dead marine mammal and

determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), SWFSC shall immediately report the incident to OPR. The report must include the same information identified in § 219.26(f)(1) of this section. Activities may continue while OPR reviews the circumstances of the incident. OPR will work with SWFSC to determine whether additional mitigation measures or modifications to the activities are appropriate.

(3) In the event that SWFSC discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 219.21(a) of this chapter (e.g., previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), SWFSC shall report the incident to OPR within 24 hours of the discovery. SWFSC shall provide photographs or video footage or other documentation of the stranded animal sighting to OPR.

§ 219.27 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, SWFSC must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of these regulations.

(c) If an LOA expires prior to the expiration date of these regulations, SWFSC may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, SWFSC must apply for and obtain a modification of the LOA as described in § 219.28 of this chapter.

(e) The LOA shall set forth:

- (1) Permissible methods of incidental taking;
 - (2) Means of effecting the least practicable adverse impact (i.e., mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and
 - (3) Requirements for monitoring and reporting.
- (f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under these regulations.
- (g) Notice of issuance or denial of an LOA shall be published in the Federal Register within thirty days of a determination.

§ 219.28 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under §§ 216.106 and 219.27 of this chapter for the activity identified in § 219.21(a) of this chapter shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for these regulations (excluding changes made pursuant to the adaptive management provision in § 219.28(c)(1) of this chapter), and

(2) OPR determines that the mitigation, monitoring, and reporting measures required by the previous LOA under these regulations were implemented.

(b) For an LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in § 219.28(c)(1) of this chapter) that do not change the findings made for the regulations or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), OPR may publish a notice of proposed LOA in the

Federal Register, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 and 219.27 of this chapter for the activity identified in § 219.21(a) of this chapter may be modified by OPR under the following circumstances:

(1) Adaptive Management – OPR may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with SWFSC regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the preamble for these regulations.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from SWFSC's monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, OPR will publish a notice of proposed LOA in the Federal Register and solicit public comment.

(2) Emergencies – If OPR determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 219.22(b) of this chapter, an LOA may be modified without prior notice or opportunity for public comment.

Notice would be published in the Federal Register within thirty days of the action.

§ 219.29 [Reserved]

§ 219.30 [Reserved]

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